



INVISIBLE EXCELLENCE

Mueller Associates and the
Art of Engineering



Mueller

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Mueller Associates and the Art of Engineering

Jason Dittrich

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FOREWORD

In 1966, four engineers in Glen Burnie, Maryland, decided to start a mechanical, electrical, and plumbing engineering design firm. They had no major clients, no guaranteed projects, and no certainty that their venture would succeed. What they did have was a commitment to quality work, a passion for solving difficult problems, and a belief that engineering could serve purposes greater than itself.

Sixty years later, Mueller Associates continues to operate upon those same principles.

I have had the privilege of spending my entire career at Mueller, from my first day in 1993, fresh out of Penn State, to my current role as president. During those three decades, I've watched the firm evolve dramatically. We have grown from hand-drafting on vellum to BIM. We have expanded our expertise from traditional building systems, to geothermal, computational fluid dynamics, and electrification. We have navigated economic recessions, technological revolutions, and a global pandemic. Yet through all these changes, the core identity of Mueller Associates has remained remarkably consistent: we do difficult work well.

That phrase—“Mueller does difficult work well”—has become something of an internal motto, and it captures what makes this firm distinctive. We don’t shy away from complexity. We seek it out. As institutions struggle to replace retiring technicians, we aim to design more intuitive systems for increasingly complex building operations.

Museums call us when they need to maintain precise environmental conditions for priceless artifacts, while also completely replacing their building systems without closing. Performing arts centers turn to us to engineer acoustically sensitive spaces, for they seek to remain nearly silent during performances.

These aren’t simple projects: they’re the kind that keep you up at night, that force you to look at problems from entirely new angles, demanding that you understand not just the systems you’re designing, but also the institutions you’re serving and the experiences you’re enabling. And that’s precisely why they’re so rewarding.

I often think of one of my early career-defining projects: the renovation of the Walters Art Museum in Baltimore. I came into that project as a young engineer, but emerged years later as a stockholder. The technical challenges were immense. But what I remember most vividly isn’t just the project’s engineering solutions. It was the constant intellectual exercise of zooming between the bigger picture and the smallest details, of understanding both the conceptual goals and the practical constraints, and of working collaboratively with clients, architects, and colleagues to find solutions that no one could have devised alone.

The Walters project taught me what “learning while doing” really means: a concept that has been fundamental since Richard Mueller and his protégé, Gene Nerf, mentored

the firm’s first generations of engineers. You do not simply read about building systems, then design them. You work alongside experts who understand the principles behind those systems—engineers who can explain why a particular approach works within one context but not another.

That knowledge multiplies across generations. The insights that Gene Nerf, Bob Marino, John Morris, Ken Rock, and countless others have shared with me are ones that I’ve also been able to pass on to other engineers: Tom Syvertsen, Rebecca Fischer, Karen Schulte, Matt Velky, and many more. They, in turn, will no doubt share those insights with the next generation. This is how institutional memory becomes institutional capability.

The book you are about to read tells the story of how that capability developed over six decades. Jason has done something I did not think was possible: he has made 60 years of engineering history read like a compelling narrative, finding the human drama in technical decisions. He has shown how a small Baltimore firm became a nationally recognized leader in complex institutional engineering. How we developed decades-long partnerships with clients such as the Smithsonian Institution, Georgetown University, the Baltimore Museum of Art, Northrop Grumman, and many others. How we pioneered sustainable design approaches at the White House and Monticello. How we have maintained a culture of mentorship and continuous learning, even as the firm has grown.

What strikes me most powerfully in reading this history is how consistent the firm’s values have remained. Richard Mueller’s original vision—that engineering should serve meaningful purposes, that quality matters more than quantity, that difficult work done well creates lasting value—still guides many of our decisions to this day.

When we won the competition for a major renovation of the Smithsonian's National Air and Space Museum in 2013—the biggest project in Mueller's history—we approached it with the same fundamental principles that guided our work in the early years of the 1960s and 1970s: a thorough understanding of the client's needs, innovative thinking about technical challenges, and an unwavering commitment to quality. That project exemplifies what I hope Mueller will continue to represent going forward. We are not just designing systems for a museum; we are helping preserve artifacts of human achievement for future generations. We are not just solving technical problems; we are enabling experiences that inspire millions of visitors.

This sense of purpose extends across everything we do. We design laboratories in which researchers can work toward curing diseases, performing arts centers in which the arts can thrive, and historic buildings that preserve cultural heritage. *This work matters.*

When I became president in 2022 after COVID-19, I was presented with challenges I had never anticipated: managing remote work, helping clients navigate unprecedented questions about indoor air quality and infectious disease control. But that experience reinforced something I had always believed about Mueller: we rise to the moment, adapting while maintaining our essential culture.

That adaptability, combined with an unwavering commitment to our core principles, is what I believe will carry Mueller successfully into its next 60 years. The engineering profession will continue to evolve. New technologies will emerge. The needs of clients will shift. Environmental challenges will intensify. But if we continue to attract people who are passionate about difficult work, who find satisfaction in solving complex problems, and who understand

that outstanding engineering serves purposes greater than itself, then Mueller's future is bright.

I'm often asked what I want my legacy as president to be. The answer is simple: ensuring that the next generation understands that Mueller's core hasn't changed—and it shouldn't. Quality work. Impactful projects. Difficult challenges resolved by innovative and simplified solutions. A culture of continuous learning and mentorship. My job is to preserve these values, ensuring that the firm evolves with changing times.

There's an old saying about standing on the shoulders of giants. That perfectly captures what it means to be part of Mueller. Every project we complete, every innovation we develop, every young engineer we mentor, builds upon the foundation laid by those who came before us. Richard Mueller, Gene Nerf, Gary Johnson, Bob Marino, John Morris, Ken Rock, Paul Czajkowski, and so many others have created something special: a firm in which engineering excellence and human connection reinforce one another, in which technical expertise serves meaningful purposes, and one in which difficult work generates not just solutions but satisfaction and pride.

This book documents that achievement. It shows how a startup became an industry leader, while maintaining its founding values. It captures the projects that challenged us, the innovations that defined us, and the relationships that sustained us. It preserves the stories and insights of multiple generations to inform the future.

As you read this history, I hope you gain not only an understanding of what Mueller has accomplished, but also an appreciation of *how* and *why*. Technical innovations matter, certainly, but they emerged from a culture that encourages

curiosity, rewards collaboration, and finds meaning in service to institutions and communities. That culture is Mueller's greatest achievement, and its legacy.

I am profoundly grateful to everyone who contributed to this book: the colleagues who shared their memories and insights, the clients who trusted us with their most challenging projects, and Jason for his dedication to telling this story with the depth and care it deserves.

Most of all, I am grateful to work alongside people who embody Mueller's values every day, approaching difficult problems with creativity and determination, mentoring the next generation with patience and wisdom, and understanding that what we do matters.

Here's to the next 60 years!

Todd Garing
President, Mueller Associates
July 2026



INTRODUCTION

In the summer of 1966, America raced to the Moon.

In Washington, D.C., architect Gordon Bunshaft began developing his striking cylindrical design for the Smithsonian Institution's Hirshhorn Museum and Sculpture Garden, which would later become a Modernist icon on the National Mall.

Star Trek premiered on television, captivating audiences with its vision of a technological future.

The Beatles released their groundbreaking album, *Revolver*, heralding a shift in popular music toward more experimental sounds.

And the Baltimore Orioles, driven by Frank Robinson's Triple Crown performance, surged toward their first World Series championship.



NASA's Apollo-era launch operations captured the technological ambition of the 1960s, the national backdrop against which Mueller Associates was founded.

Post-World War II expansion continued to reshape America: new highways, new infrastructure, and new opportunities for engineering firms willing to pursue large-scale public works projects.

Against this backdrop of technological ambition and post-war growth, four engineers south of Baltimore were making their own calculated bet about the future—and how their work might intersect with these national stories. Although highways and infrastructure projects promised lucrative contracts, they envisioned a different kind of engineering practice.

They had no major clients waiting, no guaranteed projects, and no certainty that their venture would survive. What they did have was a philosophy: *engineering should serve purposes larger than itself*. Quality mattered more than quantity. Difficult work, done well, resulted in lasting value. And if you invested in people—mentoring them, challenging them, giving them room to grow—they would build something that endured.

No one could have predicted that this modest beginning would grow into a nationally recognized practice, shaping some of America's most significant institutions for more than half a century. Sixty years later, Mueller Associates continues to operate upon those same principles.

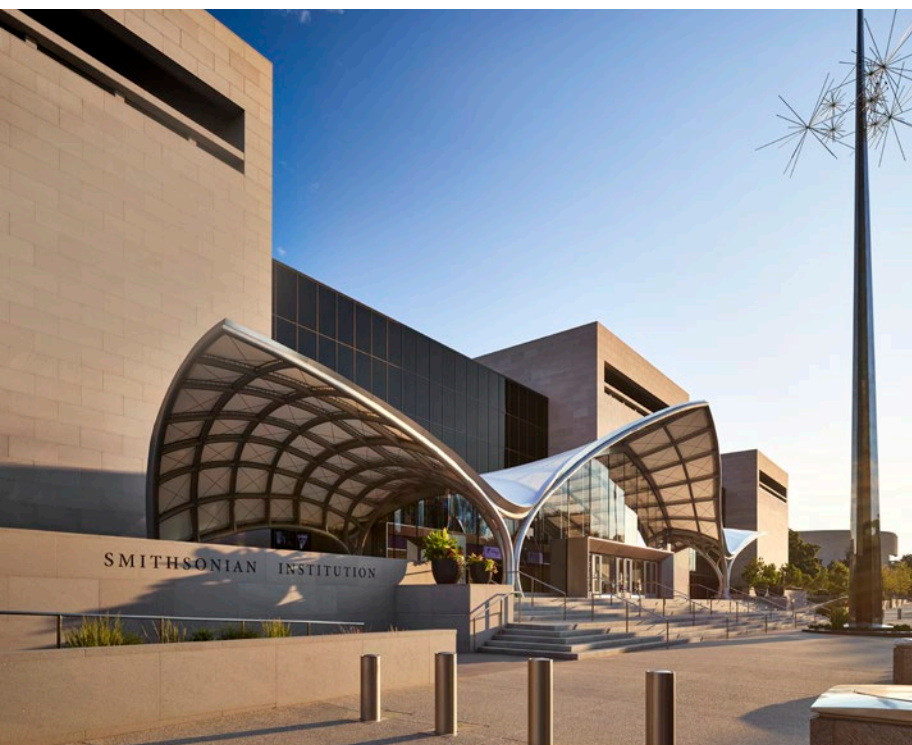
But Mueller's real achievement is not visible in any single building or innovation. It is what the firm calls "invisible excellence": engineering so precisely calibrated that it virtually disappears. Museum visitors do not notice the environmental systems protecting priceless works of art. Concert audiences do not hear the mechanical equipment supporting acoustically perfect performance halls. Researchers do not think about the laboratory ventilation systems supporting their breakthroughs. The work succeeds by becoming practically invisible.

That invisibility makes Mueller's story easy to overlook. Engineering systems do not inspire the same public fascination as architectural façades or dramatic structural elements. Mechanical, electrical, and plumbing engineering



firms rarely generate headlines. The engineers who design these systems often work in the background and behind the scenes.

Yet these systems determine whether the buildings actually function: whether museums can preserve their collections, whether performance venues can fulfill their missions, whether research facilities can support scientific discovery. Get the engineering wrong, and even the most beautiful building fails. Get it right, and the building transcends its physical structure to become something more: an instrument of institutional purpose.



Understanding how Mueller learned to get it right—consistently, across thousands of projects, through six decades—requires understanding not only technical achievements, but also institutional culture. The firm that Richard Mueller and his partners founded was not just an engineering-services business. It was a deliberate attempt to create a different kind of practice: one built upon long-term relationships with clients, an intergenerational transfer of knowledge, and a particular approach to problem-solving that treated every challenge as an opportunity to learn something new.

It fostered the kind of institutional memory that enabled younger engineers to learn directly from countless experts. The younger generation absorbed not only technical skills, but philosophical approaches to engineering as well. They learned how to zoom between big-picture thinking and granular detail, how to collaborate across disciplines, and how to understand the institutions being served, rather than just the systems being designed.

From the Washington National Cathedral to the National Air and Space Museum, Mueller has engineered some of America's defining institutions—quietly, carefully, and largely out of view.

The story begins with a small group of engineers, making a calculated bet that design quality and relationships could

sustain a business, even without the security of established clients or guaranteed revenue. It traces Mueller Associates' evolution—designing the first solar thermal panels on the White House in the 1970s through the challenging EA Engineering period of the late 1980s—to the firm's rebirth and national recognition in the 1990s and beyond.

It follows the company's emergence as a leader in complex institutional work through ongoing partnerships with the Smithsonian Institution, Georgetown University, the Baltimore Museum of Art, Northrop Grumman, and many other clients, who have returned to Mueller decade after decade, because the firm has proven that it understands their missions. This book also reveals how the firm developed expertise in performing arts venues, museums, and laboratories. It did this not through narrow specialization, but by mentoring and training engineers who would become experts in these fundamentally different types of buildings and institutional contexts.

And it explores what happened as Mueller's founding generation began to retire, passing the leadership baton to engineers they had mentored, testing whether the culture they had built could survive subsequent transitions.

The story draws upon extensive archival materials that have been meticulously preserved over the decades: newsletters containing candid interviews with Mueller's leaders, project photographs spanning decades, press releases and promotional materials documenting the firm's growth, and even handwritten documents and notes from the firm's leaders and staff. These materials, combined with interviews with current and former employees, provide an unusually detailed view of how one engineering firm evolved over the course of 60 years.

What emerges is a story about more than engineering achievement. It is about what happens when institutional memory is valued and transferred across generations. About what happens when difficult work is treated as an opportunity, rather than a burden. About what happens when client relationships are built to last for decades, rather than for individual projects. And about what happens when *invisible excellence*—engineering that succeeds by disappearing—becomes the *measure of success*.

Through thousands of projects on insitutional campuses—museums, research labs, performing arts centers, libraries, archives, and student-life buildings—Mueller's engineering solutions have supported environments in which future generations of researchers, scientists, healthcare professionals, leaders, and artists can learn and grow.

From Colonial Williamsburg and Mount Vernon to Monticello, and from Neoclassical landmarks such as the National Academy of Sciences and the Baltimore Museum of Art, to mid-century icons such as the Kennedy Center and the National Air and Space Museum, Mueller's engineers have developed specialized expertise in preserving historic buildings, designing systems that protect architectural heritage while meeting contemporary performance standards. From a single room in the Baltimore suburbs to a nationally recognized practice. From a small band of engineers to a firm that has shaped how some of America's greatest institutions preserve their collections, support their research, and inspire their visitors.

Six decades of behind-the-scenes excellence.

This is the story of Mueller Associates—the story of what engineering can be when it serves a greater purpose.



CHAPTER 1

The Early Years and the Environmental Vanguard

Like many aspiring small businesses, the story of Mueller Associates began with early promises, followed by unexpected challenges, culminating in sudden, rapid changes. Success or failure often hung in the delicate balance.

In 1963, Nelford P. Lloyd started his own engineering firm, N.P. Lloyd & Associates, in a single office in an older section of Glen Burnie, just south of Baltimore. He had only one other employee: draftsman Eugene (“Gene”) F. Nerf, Jr., age 19, who would become Mueller Associates’ third president, and its longest-tenured employee. Three years later, on February 3, 1966, Lloyd died in a traffic accident at age 38, leaving the fledgling firm without its founder.

The Lloyd family asked Richard Mueller, a close friend of Lloyd’s, to take over the business and preserve the family’s name. Having recently accepted a job with the State of Maryland, Mueller politely declined the offer. He agreed to work part-time, however, providing mechanical engineering services and overseeing the office. Another friend of Lloyd’s, David Beitman, subsequently offered to run the firm, albeit under a different name. The Lloyd family agreed to Beitman’s proposal and, on June 29, 1966, Engineering Services Company (ENSERCO) was established.

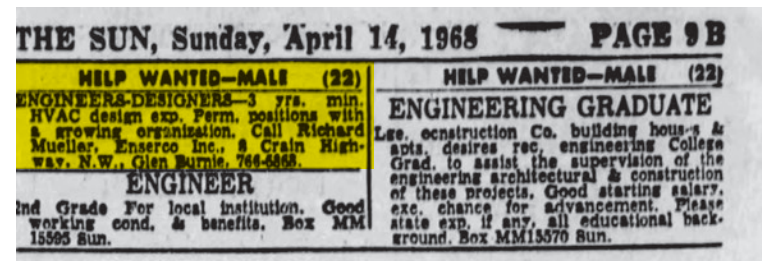
In its first year, ENSERCO relied primarily upon projects brought in by Beitman through his business connections in neighboring Pennsylvania. Beitman and the company's other stockholder, Nick Stefanelli, drove from Pennsylvania to Glen Burnie once or twice a week, bringing new work and picking up completed, hand-sketched drawings from Gene Nerf and Richard Mueller.

During their visits to ENSERCO's small office, Beitman and Stefanelli urged Mueller to join the firm full-time. After six months of persuasion, Mueller finally agreed. On January 23, 1967, Mueller joined ENSERCO as executive vice president and principal in charge, overseeing a staff of four engineers—double the number it had just four years earlier.

A MODEST BEGINNING

Born in Baltimore in 1929, at the start of the Great Depression, Richard Mueller grew up in modest circumstances, learning the value of higher education from the sacrifices his mother made while raising Richard and his brother, Harry. After serving in the U.S. Army from 1946 to 1948, Mueller graduated from Baltimore Polytechnic (Poly) Institute in 1949, and enrolled in the engineering program at Johns Hopkins University. While raising a family, he attended evening classes, and ultimately earned a Bachelor of Science degree in Engineering in 1960. During his studies at Hopkins, Mueller began his career with the engineering firm Henry Adams, where he served as a project manager from 1951 to 1961. This was followed by a short period as head of the Mechanical Engineering Department at Nash M. Love and Associates in Washington, D.C., where he worked on the first computerized central-control system for the International Monetary Fund (IMF). He then briefly served as a Staff Air Conditioning Engineer at the Maryland Department of Public Improvements, from 1965 to 1967.

When Richard Mueller joined ENSERCO, the 38-year-old brought with him a vision that foreshadowed unlimited potential, even when others might have seen only another small engineering practice operating from a modest one-room office. Wasting no time, Mueller placed "Help Wanted" ads in the local newspapers. One ad, printed in *The Baltimore Sun* on April 14, 1968, read as follows:



Mueller's confidence proved well-founded. As he began acquiring ownership of ENSERCO from Beitman and Stefanelli, "our workload increased almost immediately," he later recalled with pride.

By 1969, Mueller had doubled the firm's size to eight staff, and renamed the company "Richard P. Mueller and Associates, Inc." Over the next few years, Mueller completed his purchase of the remaining stock from Beitman and Stefanelli. He also increased local stockholder representation by appointing James L. Wetzel, a highly experienced electrical engineer. By 1971, the newly renamed firm had grown to 10 employees.

"We worked hard in those days," Mueller said years later, "sometimes around the clock to meet the deadlines established by our clients."

One of Richard Mueller's earliest and most consequential decisions was his mentorship of Gene Nerf. Nerf's involvement proved crucial to the firm's subsequent development.



Gene Nerf (left) and Richard Mueller (right). Nerf was already with the firm when Mueller took ownership, and the two men would shape its culture, its values, and its reputation for decades to come.

The educational backgrounds and work ethics of Mueller and Nerf were remarkably similar. Like Mueller, Nerf began his career at Henry Adams, after graduating from Poly and enrolling at Hopkins, and taking night classes while working for Lloyd. By 1966, through his creativity and talent, Nerf had become a lead design engineer at ENSERCO.

The Mueller-Nerf partnership further reflected the mentor-protégé dynamic that would become a hallmark of the firm's culture. "I learned something from him on every job," Nerf commented about Richard Mueller. "He said to me, 'You're not going to get anywhere in this business, including here, unless you get your degree and become a registered professional.' He held true on that." Nerf added that Mueller "was a terrific mentor with high integrity and strong convictions."

BUILDING A REPUTATION

During the late 1960s, there was a major boom in commercial office development, cookie-cutter shopping centers, and residential housing. However, instead of pursuing the lucrative yet often routine projects then emerging throughout the region, Richard Mueller intentionally directed his nascent firm toward more challenging institutional work, including government buildings, complex renovations, and historic-preservation projects.

Several early commissions laid the groundwork for this specialized focus. Installing air conditioning in the Enlisted Men's Barracks at **Andrews Air Force Base** (circa 1970) required precision and meticulous attention to detail. The mechanical and electrical modifications to Baltimore's

Monumental Life Insurance Building (1968), originally constructed in 1928, demanded both technical expertise and historical sensitivity. The expansion of **North Arundel Hospital** (now the University of Maryland, Washington Medical Center), also in 1968, marked a significant milestone in the firm's reputation. The project highlighted Richard Mueller's technical expertise, and Gene Nerf's expanding engineering capabilities. Their collaboration soon led to even more ambitious endeavors, including an HVAC retrofit of the **U.S. General Accounting Office** in Washington, D.C., around 1970—a project that earned the firm its first million-dollar commission.

But perhaps no other early project better exemplified the firm's willingness to tackle complex challenges than the Washington National Cathedral. In 1972, Richard Mueller's new company initiated the most exciting and complex project in its young history. The task of providing mechanical and electrical design for the Cathedral's West Front and towers

demanded unprecedented creativity. "It was a challenge to design custom-fit HVAC systems that could be installed and concealed within the stone and marble structure," Nerf later recalled. This project, spanning several decades, demonstrated the burgeoning firm's ability to blend modern engineering with historic preservation.

BEHIND THE STONE: ENGINEERING THE WASHINGTON NATIONAL CATHEDRAL

The Cathedral Church of Saint Peter and Saint Paul in the City and Episcopal Diocese of Washington—commonly known as the **Washington National Cathedral**, or simply the National Cathedral—is a Gothic Revival structure based on an architectural style that originated in the late 14th century. In front of a crowd of more than 20,000 spectators, President Theodore Roosevelt laid the Cathedral's cornerstone on September 29, 1907.

Construction was not officially completed until President George H.W. Bush placed the "final finial" on September 29, 1990. The Cathedral's inception, however, dates to 1792, as part of Pierre L'Enfant's "Plan of the City of Washington,"

which called for a non-sectarian, non-denominational "great church for national purposes." Church planners and architects envisioned the Cathedral as playing a role similar to that of Westminster Abbey: a national shrine serving as "a house of prayer for all people."

Spanning 83,012 square feet and stretching 518 feet in length, with a width of 234 feet at the transepts, the Cathedral's design is renowned for its pointed arches, flying buttresses, various ceiling vaults, stained-glass windows, and carved stone decorations. The central tower, known as the Gloria in Excelsis Tower, soars 301 feet above the ground. Rising higher than anything else in the area, the

tower dominates the capital city's skyline, along with the Washington Monument and the Capitol Building. Unique in North America, this central tower features two complete sets of bells: a 53-bell carillon, and a 10-bell peal to ring the changes.

In addition to its remarkable works of art, the Cathedral has more than 200 stained-glass windows, including the Space Window, which commemorates the Moon landing and contains a fragment of lunar rock at its center. This fragment was presented during a dedication service on July 21, 1974, which also marked the fifth anniversary of the Apollo 11 mission. In addition, the Cathedral features intricate wood carvings, wall-sized murals and mosaics, and grand cast-bronze gates.

The Cathedral has been home to significant cultural events, including the state funerals of five U.S. presidents (Eisenhower, Reagan, Ford, H.W. Bush, and Carter), as well as memorial and prayer services for renowned leaders such as Eleanor Roosevelt, Helen Keller, Martin Luther King, Jr., Thurgood Marshall, Nelson Mandela, John McCain, and Colin Powell.

Medieval Aesthetics, Modern Systems

From the early 1970s through the early 1990s, Mueller Associates served as the design engineer for completion of the Cathedral's infrastructure, along with its Sanctuary and West Front. Working on this iconic Gothic-style structure—the sixth-largest cathedral in the world, the second-largest in the United States, and the third-tallest building in Washington, D.C.—provided the firm's young engineers with invaluable experience in addressing the unique requirements of historic preservation, while incorporating modern systems. The successful completion

of this project opened the door to numerous other landmark cultural and institutional commissions that would define the firm's portfolio in subsequent decades, solidifying its reputation for engineering excellence in architecturally significant buildings.

The Cathedral's completion, however, was anything but assured during the years when the firm's engineers were designing its hidden infrastructure. Construction, which had cost \$65 million to date, without taking inflation into account, stopped in 1977, due to a funding shortfall. Work resumed in 1980 under a new dean and provost, John Thomas Walker, who initiated a fundraising drive and persuaded Cathedral leaders to turn down heating, reduce staff, and turn off the lights except during services. The final phase of construction began on September 30, 1985, with the laying of the first stone for the west towers—more than seven decades after Theodore Roosevelt had laid the first cornerstone.

Engineering the Invisible

The Cathedral's technical challenges were formidable, and demanded solutions as elegant as they were invisible. Mueller Associates' engineers designed intricate ductwork within the massive stone structure, combining modern systems with medieval aesthetics. The building's structural walls—limestone blocks three feet thick, with load-bearing walls extending from 10 to 12 feet in thickness—required the creative routing of systems. HVAC ducts and electrical conduits were threaded through tunnels and equipment spaces located more than 30 feet beneath the marble floors, which concealed miles of radiant-heating pipes installed during construction in the 1940s and 1970s. Custom-designed air-handling equipment was integrated across multiple floors of the adjoining towers—hidden from view, yet



An architectural rendering of the Washington National Cathedral as it appeared in the early 1970s, when Mueller Associates began the complex task of threading modern mechanical and electrical systems through walls of limestone three feet thick.

essential to the building's operation. Two large air-handling units, each capable of moving approximately 40,000 cubic feet of air per minute, would serve the main Sanctuary. The distribution of cool air was achieved via diffusers strategically placed in the second level of the Sanctuary, allowing the conditioned air to drop about 55 feet to floor level. The system was designed for a 15°F temperature change, with return air at 75°F. The return air intakes were discreetly located within the windowsills, at ground-floor level.

To meet the demands of peak cooling periods during the sweltering months of mid-July through August—when the Cathedral experiences its maximum cooling load of 400 tons (1400 kilowatts), and welcomes as many as 4,000 people—Mueller's engineers designed an innovative thermal-storage system: two chillers—one rated at 250 tons and capable of producing 12,000 tons of ice in eight-hour cycles—would be

installed at a remote plant, with utility lines extended to the Cathedral to deliver cooling capacity as needed.

Patience Rewarded

Reflecting both the foresight of Mueller Associates' engineers and the Cathedral's longstanding financial constraints, the air-handling equipment designed to circulate cool air through the Gothic structure remained idle for decades after its installation. The physical structure housing the central chilled-water plant was built in the 1960s, and the air-handling units were installed in the 1970s. But the system would not become fully operational for another three decades.

The Cathedral held its inauguration in September 1990, with U.S. President George H.W. Bush placing the final carved

final atop the structure, exactly 83 years after Theodore Roosevelt had laid its foundation stone. But the mechanical systems that Mueller Associates had so carefully designed into the building's fabric waited silently, their potential unrealized, as the Cathedral sought funding to complete the installation.

Finally, on July 17, 2000—roughly 30 years after Mueller's engineers had designed the infrastructure—the cooling system was started up for the first time. Within two weeks, with the Cathedral's massive masonry structure serving as thermal mass, temperatures within the controlled space stabilized. The invisible systems that had been patiently waiting for decades suddenly breathed life into the historical stones.

When *The Washington Post* reported on this achievement, the newspaper noted that “docents running tours make more noise than the HVAC systems,” and praised “the Cathedral's designers [Mueller Associates] who had the vision to incorporate the HVAC systems into the structure 30 years ago,” as the “real heroes.”

James Hoffman, then-executive director of facilities services at the Cathedral, reflected upon the remarkable patience and vision the project had required. “It certainly helped that the original designers left space in the Cathedral for the addition of air conditioning,” said Hoffman. He then added: “Visitors appreciate their work in August, when the temperature becomes unbearably hot.”

The successful integration of modern environmental controls made the Northwest Washington church one of the few Gothic-Revival cathedrals in the world to offer heating and air conditioning, without compromising its architectural integrity. This impressive achievement showcased the

ability of Mueller Associates to bridge centuries of building technology, while designing with a vision extending far beyond the immediate horizon.

THE ENVIRONMENTAL VANGUARD

The early 1970s brought profound changes to American society, and Richard Mueller recognized that his young engineering firm stood at a crossroads.

On April 22, 1970, an estimated 20 million Americans participated in the first Earth Day, marked by protests, teach-ins, and clean-ups, signaling the birth of the modern environmental movement. For Mueller Associates, these environmental concerns soon intersected with economic reality, in ways that would reshape the firm's future. In October 1973, the Organization of Arab Petroleum Exporting Countries (OAPEC) announced a total oil embargo against the United States. The embargo created immediate shortages and long gas lines, forcing Americans to confront their energy dependence. “Suddenly energy was the main concern,” Richard Mueller later remarked about this turn of events. Rather than merely reacting to the crisis, he strategically repositioned his firm to lead within this new environment.

Parker's Vision and Leadership

Richard Mueller's answer came in the form of a crucial hire: Andrew Parker, a fellow Johns Hopkins University alumnus whose background was well-suited to the moment. Parker came with more than 20 years of engineering experience, which read like a catalog of emerging technologies, from developing microwatt nuclear batteries for heart

pacemakers, to creating high-temperature insulation for spacecraft reentry systems. His aerospace background also gave him expertise in innovative energy applications that could be adapted to the built environment.

“Perhaps the biggest turning point for me was the decision to expand the leadership and ownership of the firm,” Richard Mueller reflected years later. “I knew Andy could open new doors with his expertise in emerging technologies. And he did—he helped bring us national exposure and enhanced our building systems work.”

Parker’s arrival in 1973 brought immediate organizational changes. He established two innovative departments within Mueller Associates: the Technology Application Division (TAD) and the Energy and Environmental Systems Department (EESD). “The creation of these new departments turned out to be perfectly timed,” said Mueller. “The emphasis on federal spending had shifted from wartime pursuits and aerospace endeavors to ecology. A clean environment was the rallying point.”

In 1974, Mueller Associates began assisting the U.S. Environmental Protection Agency (EPA) in exploring alternative fuel sources. Under Parker’s leadership, the firm pursued conservation and solar programs. “We were already on the move,” Mueller noted. “This head start placed enormous demands on us for services in the energy field.”

The EESD division quickly expanded from one to six employees, as demand for its services grew. Parker’s TAD group focused on nurturing advanced energy technologies and practical applications in buildings—an approach that would distinguish Mueller Associates from both traditional engineering firms and purely research-oriented organizations. “I had a background in aerospace engineering, and

was interested in breakthrough technologies that were just about to transition into everyday use,” Parker said. “The culture at Mueller has always embraced that kind of innovative approach. It’s a philosophy that asks, ‘How can we think ahead of the curve? How will that benefit our clients?’”

This forward-thinking philosophy proved essential as the environmental movement gathered momentum. “So much of our work at the time was atypical for engineering firms like ours,” Parker later recalled. “It was pioneering—we were on the leading edge of our profession.”

Parker’s influence extended well beyond project management. He was a prolific author, having written numerous technical standards, books, and papers on energy conservation and renewable systems. He also held membership in several professional organizations, including the American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE), the American Society of Mechanical Engineers, the International Solar Energy Society, the International Association for Hydrogen Energy, and the Engineering Society of Baltimore. His technical expertise spanned transportation systems and technology, economics, energy and environmental systems, conservation, solar energy, and alternative fuels—including alcohols and syn-fuels. It was a remarkably extensive portfolio.

Renewable Energy and Innovation

Mueller Associates’ growing expertise led to two particularly prestigious commissions: solar thermal systems for the West Wing of the White House and a congressional building on Capitol Hill. These high-profile projects demonstrated that the firm had already positioned itself at the forefront of renewable-energy applications.

The work didn't stop with federal buildings. Robert E. Hedden, a young engineer at Mueller Associates, exemplified the firm's commitment to the development of environmental expertise across multiple generations. In 1975, the Baltimore Engineers Week Council named Hedden its "Young Engineer of the Year," in recognition of his engineering achievements and professional responsibilities. Hedden had designed the solar domestic-hot-water system for the West Wing of the White House, a solar hot-water system for a restaurant in Washington, and a solar-assisted heat-pump system for the Upton Multipurpose Center in Baltimore. He also created what was described as Baltimore's first major solar energy installation, and designed an award-winning solar cooling system for the board of education in Dade County, Florida—a system utilizing more than 20,000 square feet of solar collectors, making it the largest of its kind in the country at the time.

By 1981, Parker could point to nearly 30 major solar energy systems in operation, as evidence of Mueller Associates' expertise. Under his leadership, another group within the firm, the Alternative Energy Systems Department (AESD), had made significant progress in reducing the cost of solar photovoltaic systems. Projects ranged from a 5.3-kilowatt system for MIT's Northeast Residential Experiment Station in Massachusetts, to a similar installation for the New Mexico Solar Energy Institute in Las Cruces.

One project in particular demonstrated that solar technology could deliver practical, economically viable results in everyday applications. The solar energy system that Mueller Associates developed for the Gloria Floyd Elementary School in Miami, Florida, achieved results that seemed almost too good to be true. The system provided a minimum of 70% of the annual energy requirements for cooling, and 90% of the school's hot-water requirements. What made the project

particularly significant was its design philosophy. The system was simple and operationally efficient: characteristics essential for any technology seeking to move beyond demonstration projects to widespread adoption.

The Consulting Engineers Council of Maryland selected the Gloria Floyd Elementary School solar energy system for outstanding engineering design, and entered it in the 12th annual Engineering Excellence Awards competition, sponsored by the American Consulting Engineers Council (ACEC). The project served as a successful model for future solar cooling systems, demonstrating how solar technology can dramatically reduce energy consumption, while maintaining the comfort and functionality that building occupants expect.

Expanding the Environmental Portfolio

Mueller Associates' environmental expertise extended beyond solar energy. The firm conducted an analysis of energy and mechanical systems for the National Aquarium in Baltimore, and evaluated the environmental characteristics of various energy technologies for the Department of Energy's Technology Assessment Division. Mueller's EESD department also developed flexible engineering laboratories for water and wastewater analysis, resulting in innovative designs for a wide range of projects, including a Native American school in the rugged terrain of Navajo Mountain, Utah. Between 1972 and 1981, Mueller Associates also investigated alternative fuels and transportation applications, conducting feasibility studies that ranged from Baltimore's potential conversion of idle brewing facilities, to ethanol production, to the exploration of alternative transportation fuels for highway use in Toronto.

Another notable accomplishment was the firm's work for the U.S. Department of Labor, for which it designed eight

solar energy systems to retrofit Job Corps Centers nationwide. A ten-person team at Mueller Associates completed these designs within a compressed nine-month schedule, for projects located from California to Massachusetts. All eight facilities were operational by June 1982, demonstrating the ability of the firm's engineers to scale innovative solutions across diverse geographic and climate conditions.

Strategic Expansion

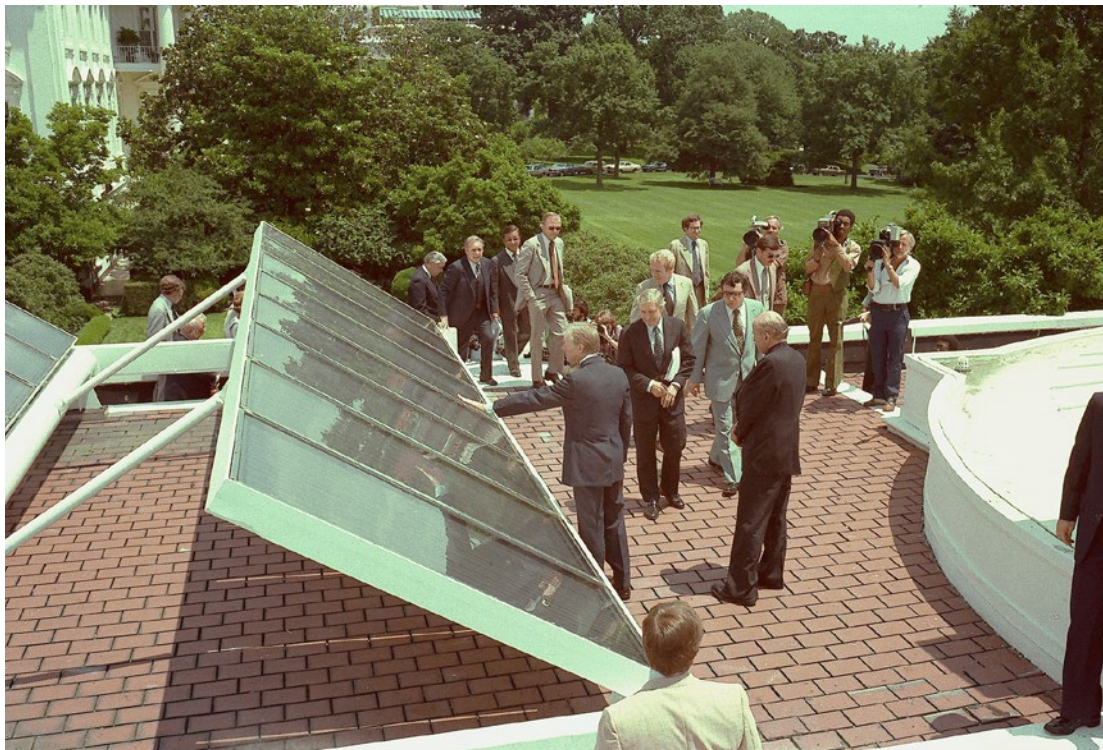
The success of these initiatives led to a significant expansion: the firm opened a Washington, D.C. office in 1981 at 600 Maryland Avenue, S.W., blocks from the newly opened National Air and Space Museum. The office included ten professionals from Mueller's design and technology-application division. Parker headed the technology-application division, while James K. Wetzel led the design division.

The Washington office represented calculated positioning at the epicenter of national energy policy. Projects at the time included the design of the solar heating system for the U.S. House of Representatives' U.S. Office Building Annex, engineering for the west front of the Washington National Cathedral, energy-conservation studies for the Smithsonian Institution, and an alternative-fuels evaluation and study for the American Petroleum Institute. The firm also provided consulting services to the Department of Energy (DOE) and other governmental agencies.

Mueller Associates' environmental leadership earned its principals widespread professional recognition. Richard Mueller was elected President of the Baltimore Chapter of ASHRAE in 1979, while in 1984 Andrew Parker received the "Outstanding Engineer of the Year" Award from the Engineers Week Council of Baltimore, for his engineering proficiency and professional responsibility.

In 1984, Parker's leadership was formally recognized within Mueller Associates, when he was elected the firm's second president, a role in which he served until 1991. His transformation of Mueller Associates, from a regional engineering firm into a nationally recognized leader in environmental technologies, established patterns that would define the company for decades: embracing emerging technologies, pursuing challenging projects, and positioning the firm ahead of industry trends.

As Parker proudly said in 1981, "Our claims are supported by nearly 30 major systems in operation. [...] We have been consistently at the forefront of solar and other building application technologies." This wasn't merely marketing rhetoric; this reflected a fundamental commitment to innovation that Richard Mueller had instilled from the firm's earliest days.



President Jimmy Carter inspects the newly installed solar thermal panels on the White House roof in June of 1979. Engineered by Mueller Associates, the system represented both a practical engineering achievement and a national statement about America's energy future—one Carter himself acknowledged might prove to be “a road not taken.”

MUELLER'S SOLAR INNOVATION: POWERING THE WHITE HOUSE

During the 1970s energy crisis, as Americans faced gasoline shortages and skyrocketing utility bills, President Jimmy Carter made a bold statement about the nation's energy future. In June 1979, the **White House** itself became a showcase for renewable energy, with the installation of 32 solar thermal panels on its roof—and Mueller Associates played a crucial role in this historic project.

The firm's involvement in the project arose from its established relationship with the DOE and its recognized expertise in solar applications. Having designed several innovative solar installations throughout the Baltimore-Washington region, Mueller Associates contributed valuable practical

experience to this high-profile project. The firm engineered solar thermal panels for installation on the White House roof to heat water for the presidential residence, providing both practical benefits and significant symbolism. The panels supplied nearly 75% of the energy needed to heat 1,000 gallons of water daily in the White House kitchens.

Later remarking upon the significance of this moment, Gene Nerf said, “It is clear that Andy Parker's background in breakthrough technologies positioned Mueller perfectly for this moment. When the White House needed expertise in renewable energy, our firm's reputation for innovative, forward-thinking engineering made us a natural choice.”

The design and installation of thermal panels on the White House roof required meticulous integration of the solar energy system with the building's existing infrastructure—exactly the kind of challenge that Mueller Associates had become known for handling with distinction.

The installation of solar thermal panels on the White House, and Mueller's broader solar portfolio throughout the 1970s and early 1980s, represented the firm's participation in a national conversation about energy independence that Carter had hoped to make permanent—proven by subsequent history to be anything but. The engineering that Mueller's team had performed remained sound long after the political will to sustain it had faded.

For Mueller Associates, the engineering and installation of solar thermal panels at the White House was not just a prestigious project; it was a profound statement about the firm's vision for a more sustainable future—one that echoes to this day.

A FOUNDATION FOR THE FUTURE

The environmental movement of the 1970s had created an opportunity, but it was the strategic response of Richard Mueller and Andrew Parker—hiring the right engineers, creating new organizational structures, and pursuing pioneering projects—that established the firm as an industry leader. This approach would serve as a template for future innovations, from Building Information Modeling (BIM) to sustainable design, as Mueller Associates continued to anticipate and lead industry changes, rather than simply reacting to them.



VOLUME I, NUMBER 2

D. McClellan, Editor

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Mayor Marks MAI Ground Breaking



Mayor Schaefer celebrates ground breaking with R.P. Mueller (r.), A.J. Parker, Jr. (l.), MAI staff and guests. Story, page 4.

Technology Application Division Bridges Gap Between R&D and Reality

- A. J. Parker, Jr., Director

What is the Technology Application Division? How does the division's role integrate with a more traditional consulting engineering role? In introducing my division to you, I hope to answer these and other frequently asked questions.

Over the course of my career, I had perceived a gap between traditional engineering and the research and development communities' approaches to applying innovative energy technologies. There was a need for services in that difficult transition of a concept from the drawing board to the real world — to commercial viability. I found enthusiasm for my thoughts at MAI, and this service concept became a fundamental element of MAI's business philosophy.

In early 1973, the Technology Application Division was created to nurture advanced energy technologies toward practical application in the building/industrial sector. Nearly nine successful years later, I think it is safe to say our idea and our

On June 29, 1981, to commemorate its 15th anniversary, Mueller Associates broke ground for its new corporate headquarters. Located in the recently developed Caton 95 Office Park—strategically positioned just off Interstate I-95, inside the Baltimore Beltway at the city-county line—the new facility underscored the firm's remarkable growth within a relatively short period.

Among the dignitaries joining Richard Mueller, Andrew Parker, and other leaders was Baltimore Mayor William Donald Schaefer, who praised Mueller Associates as an example of the "great" firms building "choice business communities" in partnership with the City of Baltimore. The celebration reflected not only the firm's professional success, but also its community spirit. That same summer, the firm's softball team capped a stellar 9-2 season with a "hair-raising" 9-8 playoff victory over engineering competitor Gipe Associates, claiming the 1981 Architects & Engineers Softball League Championship.



CHAPTER 2

Advancing Long-Term Partnerships

While advancing environmental technologies for sustainable design on projects such as the Washington National Cathedral and solar-thermal panels at the White House, Mueller Associates also began cementing its reputation within the broader cultural and institutional sectors.

The mid-1970s marked a turning point. Within a span of roughly two years, the firm entered into several relationships that would collectively span more than a century of accumulated work: the Lyric Opera House, which was at the center of one of Baltimore's most closely watched preservation battles; the Baltimore Museum of Art where precision, measured in fractions of a degree, separated preservation from deterioration; and Northrop Grumman, whose first project would grow into more than 1,000 distinct assignments over five-plus decades.

These partnerships—a performance venue, an art museum, and a defense contractor—could scarcely have differed more in their missions and cultures. Yet each began with a single technically demanding project and deepened through consistent execution into a genuine, lasting partnership. The story of Mueller Associates in these years is not merely one of engineering competence: it is about how trust is built, one invisible solution at a time.

PRESERVING BALTIMORE'S ACOUSTICAL JEWEL: THE LYRIC OPERA HOUSE

Modeled after Leipzig's Neues Gewandhaus—a celebrated German concert hall launched in 1884—Baltimore's **Lyric Opera House** opened on October 31, 1894, with a performance by the Boston Symphony Orchestra, and Australian opera singer Nellie Melba as the featured soloist. Beginning in 1904, it also hosted touring performances by the Metropolitan Opera and, from 1950 until 2009, served as the home of the Baltimore Opera Company. The Doors, fronted by Jim Morrison, even performed at the historic venue in 1967, at the height of the band's popularity.

Although renowned worldwide for its outstanding acoustics, the Lyric Opera House faced an existential crisis by the mid-1970s. The hall's uncomfortable seats, lack of air conditioning, and outdated amenities—combined with mechanical systems that had scarcely been updated since opening night—sparked a heated debate that would dominate Baltimore's cultural conversation for years. Should this beloved but deteriorating landmark be demolished or restored?

The Baltimore Sun covered the controversy extensively from 1976 to 1978, returning to the story repeatedly as the Lyric Foundation—a private organization controlled by the University of Baltimore Educational Foundation—faced severe financial constraints and mounting pressure to decide the Lyric's fate. The volume and intensity of press coverage reflected the high stakes: this was not merely an infrastructure question, but a test of Baltimore's commitment to preserving its cultural heritage.

The debate reached its peak in mid-1978, when *The Baltimore Sun's* editorial board weighed in with a July 4 piece

titled "On with the Lyric." The editorial acknowledged the project's challenges: costs that exceeded initial projections, complex negotiations between city and state governments over funding obligations, and ambitious private fundraising goals that the Lyric had previously failed to meet. Yet the alternative—allowing Baltimore's acoustical jewel to be lost to demolition—was unacceptable. The Lyric Foundation, the editorial argued, was right to proceed with restoration, rather than wait for construction costs to rise further, and the building to deteriorate beyond saving.

Engineering the Invisible

When the Lyric Foundation committed itself to preserving the Opera House in the late 1970s, Mueller Associates was entrusted with one of the project's most critical challenges: integrating modern mechanical, electrical, and plumbing systems without compromising the very characteristic that made the building worth saving: its legendary acoustics. For a young firm still seeking to establish its credentials, this high-profile, closely scrutinized project represented both an opportunity and a risk.

"The Lyric presented a fascinating engineering puzzle," said Gene Nerf, who led much of Mueller Associates' early work at the Lyric. "We had to make the building meet modern expectations for comfort and safety, without altering the very characteristics that made it special. The mechanical systems needed to be both powerful and whisper-quiet—a challenging combination."

During his initial visits to the Lyric, Nerf observed that the original systems, dating back to the 19th century, were still

in use. Nearly 90 years old, these systems were, of course, utterly inadequate for a modern performance venue. Under Nerf's leadership, Mueller Associates' engineers designed new environmental-control systems that met contemporary standards, without affecting the theater's world-renowned acoustics, and leaving no visible evidence in the performance hall. The building's physical plant also had to operate as economically as possible: a critical consideration, given the financial pressures that had nearly led to the building's demolition.

The successful completion of this politically sensitive, technically demanding project established Mueller Associates' expertise in performing arts venues, where precise environmental control and unobtrusive systems are essential. More importantly, it demonstrated the firm's ability to deliver results on projects where failure would be both highly visible and culturally consequential. The Lyric Foundation took notice. What began as a single commission would evolve into a partnership spanning four decades.

The 1982 Transformation

The success of Mueller Associates' work on the Lyric in the late 1970s led directly to the firm's involvement in another renovation at the Opera House. In 1982, Mueller contributed engineering expertise to an \$11-million renovation that fundamentally transformed the patron experience, while preserving the hall's acoustical integrity. As *The Baltimore Sun* reported, the renovation "built a new lobby and changed the configuration of the hall's 2,600 seats," addressing the comfort-related issues that had nearly led to the building's demolition a few years earlier.

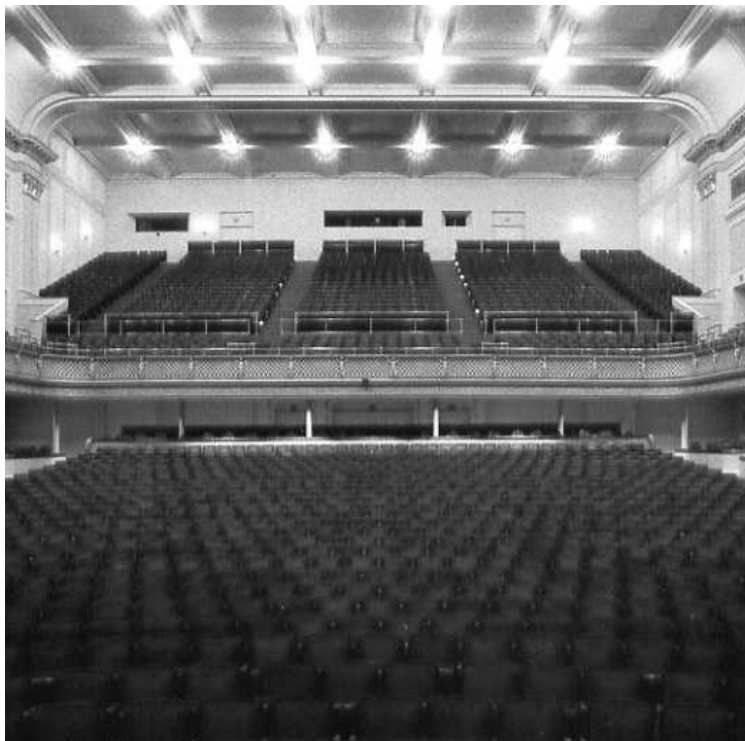
The new lobby presented its own engineering challenges. Mueller Associates had to design mechanical systems that

could maintain comfortable temperatures in a high-traffic public space with frequent door openings, while ensuring that lobby noise and temperature fluctuations did not affect the auditorium environment. The transformation of the Lyric's 2,600 seats required recalculating air-distribution patterns, as the new seating configuration altered the hall's thermal dynamics. Every modification had to be tested against its potential impact on acoustics: the very quality that made the building worth preserving.

Mueller's mechanical, electrical, and plumbing systems supported this comprehensive modernization, ensuring that enhanced amenities—including the air conditioning patrons had long demanded—did not compromise performance quality. The complexity of integrating modern comfort systems into a historic performance hall cannot be overstated. Mueller's engineers routed ductwork through spaces never designed to accommodate it, designed equipment that would not generate vibrations perceptible to audiences, and engineered controls that would maintain precise environmental conditions without generating background noise that would compromise the hall's acoustical excellence.

When the renovated Lyric reopened, the transformation was immediately apparent to patrons. Comfortable seating, climate control, and modern amenities had converted what many had considered an obsolete facility into a venue capable of competing with any performance hall in the Mid-Atlantic.

Yet the measure of Mueller Associates' success lay precisely in what audiences did *not* notice: the mechanical systems that made comfort possible, the electrical infrastructure that supported modern theatrical lighting, the plumbing that served new amenities. All had been integrated so seamlessly that they virtually disappeared.



The Lyric Opera House in the early 1970s, before Mueller Associates began a four-decade partnership that would encompass several major renovations—bringing the historic venue into the modern era.

The 1982 renovation represented not only a quantum leap from the building’s previous condition, but also a validation of Richard Mueller’s philosophy that the best engineering enhances without intruding.

A Continuing Partnership

Mueller Associates remained involved with the Lyric throughout the 1980s and 1990s, contributing to incremental upgrades that kept the building’s systems current, without requiring disruptive major renovations. In 1989, *The Evening Sun* reported on the Lyric Foundation’s plans for another expansion, this time to better accommodate

Broadway touring companies: “Since 1982, an additional \$2 million has gone into the hall for smaller improvements.” This ongoing investment also reflected the Lyric Foundation’s confidence in Mueller Associates as a long-term partner that understood the building’s systems, history, and mission.

A 1989 expansion proposal highlighted the Lyric Foundation’s strategic approach to serving different constituencies. “We started by making the patrons happy,” said the Foundation’s leadership. “Now we’re going to make the artists happy.” This evolution, from ensuring the comfort of patrons to accommodating the needs of performers, required engineering flexibility and institutional knowledge that only

a long-term partner could provide. Mueller Associates' engineers had developed intimate familiarity with the Lyric's systems, spatial constraints, and operational requirements: knowledge that made each successive project more efficient and effective than any outside firm could achieve if starting from scratch.

Stagehouse Expansion and Transformation

More than two decades after the Lyric Foundation first proposed expanding the theater to accommodate larger touring productions, that ambition culminated in a comprehensive transformation of the stagehouse.

Completed in 2011, the Lyric's Stagehouse Expansion was one of Mueller Associates' most technically challenging theater-engineering projects and represented the firm's fourth decade of continuous service to the venue. The renovation transformed the main stage to better accommodate Broadway touring companies and required a complete reconceptualization of the theater's vertical space and infrastructure.

The engineering challenge was considerable. The existing stagehouse roof had a central ridge, with a slope and elevation similar to the roof over the main seating area. This configuration left insufficient vertical space to raise scenery fully above the stage and out of the audience's view. To provide the fly space required for grand opera and major touring productions, Mueller's engineers determined that the stagehouse roof would need to be removed and reconstructed approximately 94 feet above the stage.

This significant increase in height allowed large stage scenery to be lifted directly without tipping, using a new gridiron positioned about 84 feet above the stage. The existing rope

rigging and wooden pin rails were replaced with state-of-the-art motorized rigging and steel cables. The renovation also included a pit lift and an enlarged loading dock, to accommodate two simultaneous opera productions.

Mueller's mechanical-engineering solutions for the stagehouse required exceptional creativity, given the theater's limited space. The HVAC work included a new cooling tower for the entire building, and updated duct-distribution systems serving the stagehouse. New ductwork extended from the existing air-handling unit that serves the stagehouse, across a low roof within a new architectural enclosure, and into the edge of the stagehouse structure.

Maintaining the required rigging clearances while maximizing the usable stage area made ductwork routing particularly challenging. "Clearance requirements on all sides of the stage left little space for ductwork," recalled Paul Czajkowski, the project's lead mechanical engineer. "The ducts could not cross above the stage because of the rigging and scenery, so they had to pass outside the building at roof level." Delivering air back into the stagehouse required extraordinary precision. "I measured to the inch to make sure the ducts would fit," he said. "And these were large ducts, moving a tremendous amount of air."

The ductwork was routed across the high stagehouse roof within an architectural enclosure, then down the opposite exterior wall. Air was delivered to the stage through new diffusers in the left and right walls, approximately 10 feet above the fly-floor platforms. To preserve the maximum usable space for performances, rigging, scenery movement, and other essential stage operations throughout the full height of the stagehouse, no ductwork or piping could project more than six inches beyond the stagehouse walls, from the stage floor to the gridiron above.

Czajkowski also made a remarkable find during the renovation: “There was more hemp rope lying on the platforms in the upper stagehouse than you would find on a Baltimore clipper ship. It was just lying there, piled on top of itself in layers. This could not have made the fire marshal happy.” All of this outdated rigging was replaced with steel cables neatly contained in modern rigging machinery: a change that improved both safety and operational efficiency.

The plumbing and fire-protection systems required equally sophisticated engineering. New piping was provided at multiple levels, including the underside of the roof, the underside of the gridiron, the underside of the loading bridge, and the underside of the fly-floor platforms on each side of the stagehouse. Large-drop sprinkler heads were installed on the underside of the gridiron, due to its considerable height above the stage.

New electrical systems supporting the renovation included relocating company switches, along with comprehensive upgrades to support the new motorized rigging system and the enhanced lighting capabilities required for modern productions.

A Legacy Transformed

When the Lyric’s Stagehouse Expansion was completed in 2011, Mueller Associates engineers had accomplished something remarkable: they had transformed a 19th-century music hall into a venue capable of hosting the most demanding 21st-century productions—without compromising the acoustical excellence that had made it famous. The 94-foot-high stagehouse, its sophisticated motorized rigging systems, and precisely calibrated HVAC controls that maintained comfort without creating air currents—all engineering solutions that would have been

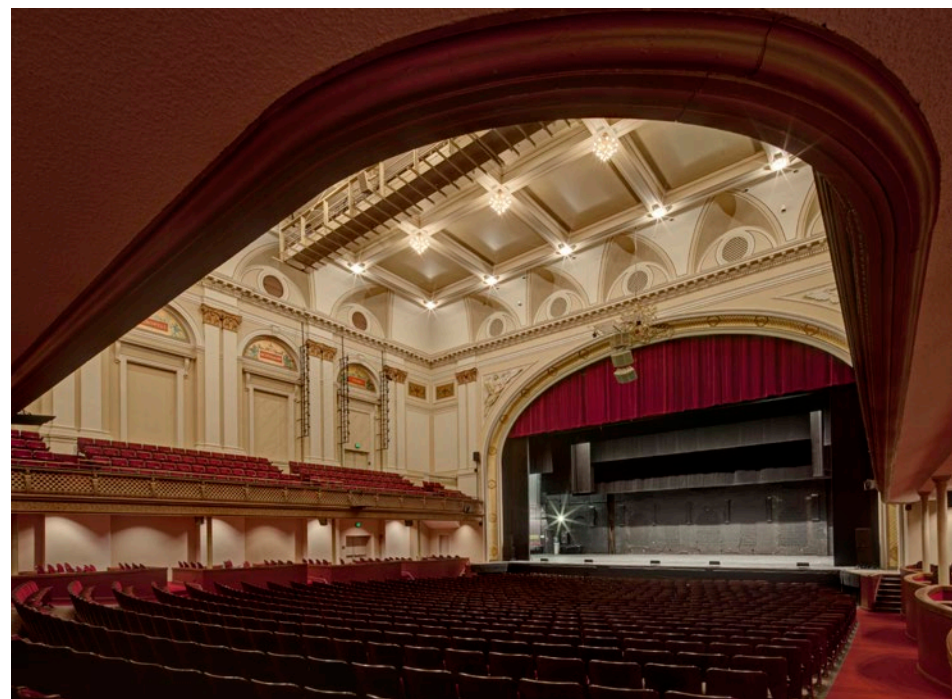
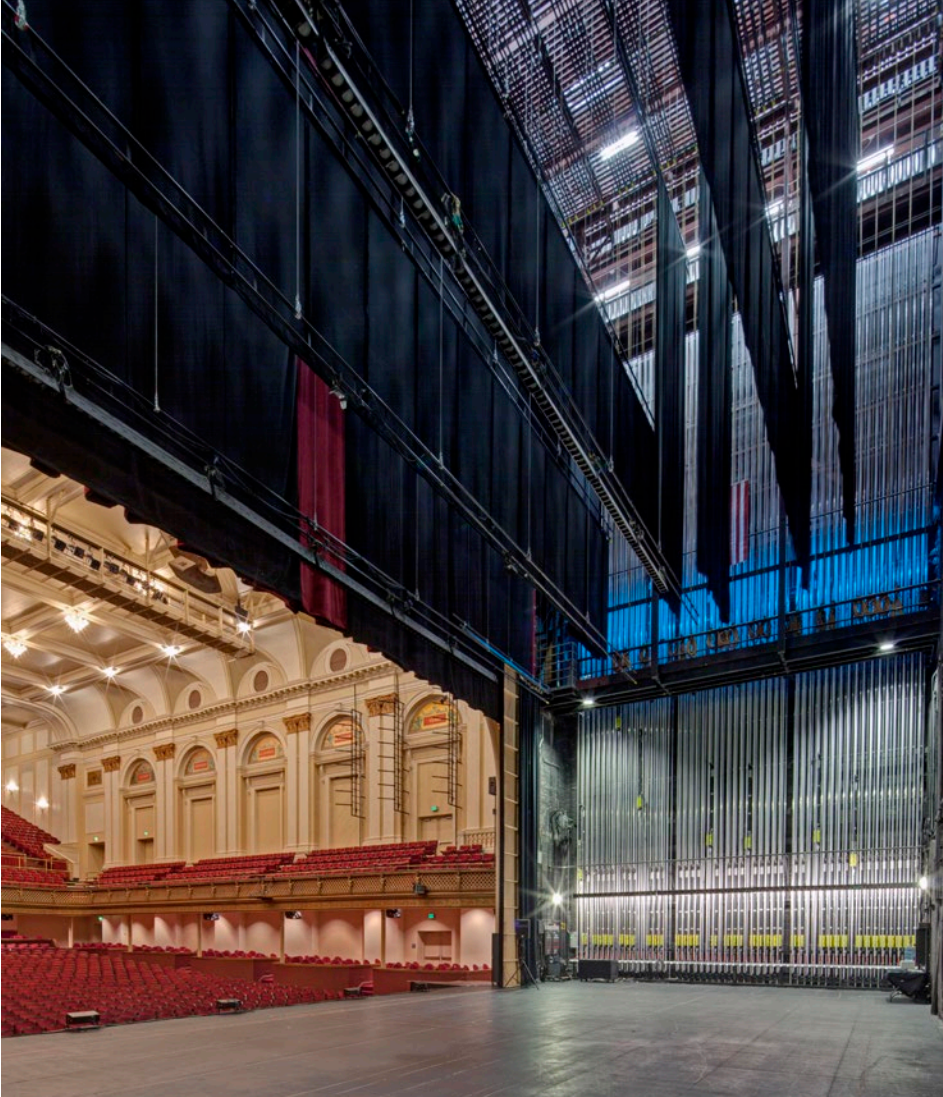
impossible in the 1970s, when Mueller Associates first worked on the building. Yet the firm’s fundamental approach remained unchanged throughout the decades: respect the architecture, understand the mission, and deliver systems that enhance rather than intrude.

Paul Czajkowski’s memory of hemp rope piled on the upper stage platforms captured the transformation visually. What had once been a fire hazard requiring manual operation had become a state-of-the-art theatrical facility with computerized controls and safety systems. But the real measure of success was not in the technology itself; it was that audiences and performers noticed only the improvement in comfort and capability—not the engineering that made it possible. As Gene Nerf had learned from Richard Mueller decades earlier, the best engineering is often invisible.

Four Decades of Partnership

The Lyric projects—from the politically charged preservation fight of the late 1970s, through the comprehensive 1982 renovation, to the Stagehouse Expansion of 2011—proved instrumental in establishing the reputation of Mueller Associates, both within Baltimore’s cultural community and beyond. Sustained media coverage throughout the initial preservation battle elevated the Lyric’s renovations from simple infrastructure projects to a closely watched test of Baltimore’s cultural priorities. Mueller’s success on such a high-profile, technically demanding, and politically sensitive project clearly demonstrated the firm’s capabilities, opening doors to other prestigious cultural institutions.

More importantly, the four-decade relationship with the Lyric Opera House demonstrated a model of client partnerships that would define the firm’s growth: exceptional work on a single project leading to trust, trust leading to



partnership, and partnership enduring across decades, leadership transitions, and evolving building needs. Mueller Associates had shown that complex cultural venues—with their demanding acoustical requirements, their need for environmental precision, and their obligation to preserve historical character—required engineers who approached each project not as a technical challenge to be solved, but as a cultural treasure to be enhanced. This philosophy, refined through the Lyric projects, led to partnerships that would define the firm’s portfolio for the next half-century.

The Lyric Opera House following the 2011 Stagehouse Expansion. Four decades after Mueller Associates’ first engagement, the partnership had transformed a beloved but aging hall into a world-class performance venue.

THE BALTIMORE MUSEUM OF ART: A PARALLEL PARTNERSHIP

In 1975, as Mueller Associates worked on the Lyric's initial renovation, the firm embarked on another defining cultural partnership by designing environmental-control systems for the **Baltimore Museum of Art (BMA)**. If the Lyric demanded acoustical sensitivity and patron comfort, the BMA presented engineering challenges of a different order: the precise environmental control required to preserve irreplaceable works of art.

Museums operate under constraints that would seem impossibly stringent to those unfamiliar with conservation science. Temperature fluctuations of even a few degrees can damage paintings, textiles, and works on paper. Variations in humidity can cause materials to expand and contract, leading to cracking, warping, and deterioration. Vibrations from mechanical equipment can compromise delicate objects. UV radiation from lighting accelerates fading and chemical degradation. Mueller's engineers had to design systems that could maintain conditions within narrow tolerances, year-round and around the clock, while keeping those systems both invisible to visitors, and silent enough not to intrude upon the museum experience.

The initial 1975 project established Mueller's ability to work within the stringent requirements demanded by cultural institutions. Where commercial buildings might tolerate temperature swings of several degrees, the BMA required precision measured in tenths of a degree. Where typical HVAC systems cycle on and off to maintain setpoints, museum systems require continuous operation to avoid the fluctuations that come with cycling. Mueller's engineering solutions had to account not just for the art on display,



but also for the changing loads created by visitors moving through galleries, by the heat generated from lighting systems, and by external weather conditions that varied dramatically between Baltimore's humid summers and cold winters.

This initial project would ultimately lead to dozens of separate projects with the BMA over the ensuing half-century. The Museum's confidence in Mueller grew with each successful project, leading to commissions for new wings, gallery renovations, and systems upgrades to support the institution's expanding collections and evolving mission. Like the Lyric relationship, the BMA partnership demonstrated that Mueller's approach to unseen, preservation-sensitive engineering could serve diverse cultural institutions, while building the kind of trust that transforms contractors into long-term partners.

Further information on the Mueller-BMA partnership is provided in **Chapter Eight**.

BUILDING RELATIONSHIPS, NOT JUST BUILDINGS

The partnerships with the Lyric and the BMA, both initiated in the mid-1970s, revealed something essential about the approach that Mueller Associates took to client relationships. These were not transactional engagements in which the firm completed a project, then moved on to the next commission. They were the beginning of decades-long collaborations that were built upon technical excellence, yes, but also upon something less tangible: the trust that comes from understanding a client's mission, constraints, and aspirations.

Gene Nerf observed that successful long-term partnerships required more than engineering competence. "You have to become part of the client's team," he said. "Not just understand their building, but understand their goals, their challenges, their culture. When they know you're invested

in their success, not just in completing the contract, the relationship changes." Richard Mueller had established this philosophy from the firm's founding, emphasizing that every project was an opportunity to demonstrate not just technical capability, but also commitment to the client's long-term success.

Yet, as Mueller Associates would demonstrate through another relationship that also began in the 1970s, these principles of trust-building and long-term partnership applied far beyond the cultural sector. Work within the defense industry demanded different capabilities—rapid response, security protocols, adaptability to classified requirements—but the fundamental approach and ultimate goals remained the same: earning trust, understanding the client's needs, and becoming a valued long-term partner.

A THOUSAND PROJECTS AND COUNTING: NORTHROP GRUMMAN

Within the landscape of Mueller Associates' client relationships, few have been as enduring or significant as its partnership with **Northrop Grumman**. What began in 1976 with a specialized defense project has evolved into one of the firm's most substantial and long-lasting collaborations, spanning more than five decades, multiple geographical locations, and more than 1,000 distinct projects.

The relationship's origins date back to Mueller Associates' first assignment: engineering the E3A Test Area, a testing site for the U.S. Air Force Airborne Warning and Control System (AWACS). This initial project presented formidable

technical challenges, requiring custom air- and water-cooling systems, and meticulous coordination with the client and government officials in order to meet the exacting requirements of sophisticated testing equipment.

Engineering for National Defense

The AWACS testing facility demanded engineering capabilities distinct from Mueller's work with cultural institutions. The sophisticated radar and electronic-testing equipment generated significant heat loads, while requiring environmental stability that rivaled museum

conservation standards—but for entirely different reasons. Whereas museum systems protected collections from fluctuations in temperature and humidity, the AWACS facility required stable conditions to ensure accurate, repeatable test results for equipment that would operate in aircraft defending U.S. airspace. The security requirements alone presented challenges unfamiliar to engineers accustomed to cultural projects. Coordination required adherence to classified specifications, and design-review processes that involved both corporate and government oversight. The schedule demanded rapid response; whereas cultural institutions typically planned renovations years in advance around exhibition schedules, defense work operated on compressed timelines driven by contract deliverables and operational imperatives.

“What began as a single project grew into one of our most important client relationships,” said Nerf, who managed many of these early commissions. “The relationship endured through corporate changes, evolving defense priorities, and technological advancements, becoming a cornerstone of our portfolio.” The successful completion of the AWACS testing facility established Mueller Associates’ credentials, demonstrating capabilities that would lead to steadily expanding engagement with the company through the 1980s and the early 1990s.

Expansion and Evolution

Following Northrop Grumman’s acquisition of a portion of Westinghouse in 1996, Mueller’s defense-contractor work expanded significantly in both scope and reach, with the firm completing projects not only throughout Maryland, but also across the Northeastern U.S., Mexico, and Puerto Rico. The Westinghouse acquisition transformed the relationship, as Mueller’s engineers found themselves supporting

a vastly larger portfolio of facilities, with diverse missions and requirements. Most of these assignments supported Northrop Grumman’s Mission Systems division, highlighting Mueller’s ability to manage projects of increasing complexity and sensitivity.

This geographical expansion tested the firm’s organizational capabilities. Projects in Puerto Rico and Mexico required adaptation to different building codes and construction practices, and the management of local contractor relationships, all while maintaining the quality standards set by Northrop Grumman. Mueller Associates also had to develop systems for remote project oversight, establish protocols to ensure consistent quality across dispersed locations, and build expertise in jurisdictional requirements beyond its own Maryland headquarters.

The technical diversity of these projects is impressive: systems design for industrial facilities, electronics testing and assembly spaces, and laboratory retrofits; engineering for cleanrooms, anechoic chambers, plating facilities, and secure areas; renovating office fit-outs; updating equipment utilities; and designing comprehensive infrastructure upgrades.

Each type of project demands specialized knowledge. Cleanroom design requires an understanding of particulate control and laminar flow. Anechoic chambers requires expertise in electromagnetic isolation and radio-frequency engineering. Plating facilities requires corrosion-resistant materials, and the management of chemical fumes.

Although the specific sizes and construction values remain confidential for security reasons, they range from targeted interventions to significant facility transformations. One of Mueller Associates’ most significant projects involved

engineering a 100,000-square-foot expansion of Northrop Grumman's Central Services Building near Baltimore-Washington International (BWI) Airport. Mueller also managed phased improvements in facility infrastructure at Northrop Grumman's Sykesville, Maryland campus, and completed a central plant expansion and upgrade of utility infrastructure at its Applied Technology Lab (ATL).

Strategic Defense, Strategic Partnership

What distinguishes Mueller Associates' approach to this relationship is the firm's ability to adapt to the fast-paced schedules and evolving requirements that define the defense industry. Just as Northrop Grumman must respond to the changing needs of its clients, Mueller has cultivated exceptional agility in adjusting perspectives and strategies, while staying focused on objectives and the overall mission. This close collaboration has been essential in meeting the high standards required for mission-critical tasks.

The contrast with work in cultural institutions is instructive. Where museums and performance venues plan renovations years in advance—coordinating around exhibition schedules and performance seasons—defense facilities operate on accelerated timelines driven by program requirements and operational deadlines. Where cultural projects prioritize aesthetic discretion and historical sensitivity, defense installations demand security, redundancy, and the ability to adapt to rapidly evolving technological requirements. Yet the fundamental approach—understanding the client's mission, anticipating needs, delivering solutions that enhance rather than constrain operations—remains consistent across these seemingly disparate sectors.

Mueller's engineers work closely with Northrop Grumman's representatives, ensuring that each project meets the

contractor's operational needs and adheres to the strict security and performance requirements that are vital in defense work. For his part, Nerf attributed much of the Mueller-Northrop Grumman relationship's success to a collaborative approach developed over decades. "We've become intimately familiar with their standards, their processes, and their expectations," he said. "We collaborate on every assignment, and it often seems as if we are an extension of their group."

This sense of integration between client and consultant reflects Mueller Associates' approach to building long-term relationships, making it not merely a service provider, but a trusted partner with a thorough understanding of the client's facilities, needs, and objectives. The Northrop Grumman relationship, now in its fifth decade, attests to the value of this approach, and to the ability of Mueller Associates to evolve and grow alongside its clients.

From the first AWACS testing facility in 1976, to today's advanced defense installations, Mueller Associates has proven that engineering excellence, combined with institutional knowledge and responsive service, can build client relationships that endure—at 1,000 projects and counting.

By the end of the 1970s, Mueller Associates had established a pattern that would define its growth for decades to come. The firm had demonstrated that technical excellence, while necessary, was not sufficient to build the kinds of partnerships that would characterize its most important client relationships. The Lyric, the BMA, and Northrop Grumman—three clients with vastly different missions, operating in entirely different sectors, serving different constituencies—all came to rely upon Mueller not merely as engineers, but as trusted partners who understood their institutions as thoroughly as their own staff.



Northrop Grumman's campus in Linthicum, Maryland, one of many facilities where Mueller Associates' engineering supports the infrastructure behind one of the most advanced defense and aerospace contractors in the United States.

Gene Nerf's observation that Mueller had become "an extension" of Northrop Grumman's group applied equally to the firm's partnerships with cultural institutions. Whether serving performance venues that demand acoustical precision, museums that required conservation-grade environmental controls, or defense facilities that needed rapid response, Mueller has established itself as a firm that approaches each client relationship not as a series of discrete projects, but as an ongoing partnership rooted in mutual trust and a shared commitment to success.

These partnerships, built in the 1970s upon a foundation of technical excellence, and deepened through decades of consistent performance, laid the groundwork for the expansion of Mueller Associates into ever-more-complex and prestigious commissions. The firm had learned that excellent engineering, delivered invisibly in the service of a client's mission, was the first step in relationships that could span generations.



CHAPTER 3

The Technological Revolution Accelerates

The 1980s ushered in a profound transformation for Mueller Associates, marked by growth that would have seemed impossible when Richard Mueller first joined ENSERCO. The numbers told a remarkable story: from approximately \$67,000 in gross revenue in 1967, the firm had achieved \$3 million by 1980, and \$4 million just two years later—a nearly 60-fold increase within 15 years.

This explosive growth necessitated physical expansion to keep pace. In 1983, Mueller Associates relocated to a new corporate headquarters at 1401 South Edgewood Street, Baltimore, where it would remain for the next 34 years. The 17,000-square-foot, two-story brick building represented a dramatic expansion from the firm's humble beginnings. (In 1972, Mueller Associates had operated from just 2,000 square feet, growing to 10,000 square feet a decade later, at an office building on Sulphur Spring Road in nearby Halethorpe.) Combined with the firm's newly leased Washington, D.C., office, this growth reflected both Richard Mueller's original vision and the exceptional results achieved through the firm's focus on complex institutional projects.



Mueller Associates headquarters on South Edgewood Street in the early 1980s. It was the physical embodiment of a firm that had outgrown its initial structure, and was just beginning to hit its stride.

Beyond physical expansion, the early 1980s marked a strategic inflection point for Mueller Associates. In 1982, the firm implemented a comprehensive business strategy designed to respond to the changing economic climate, including the addition of selected new engineering services, and a revised organizational structure. This was underscored by a renewed commitment to excellent service: a principle that had distinguished Mueller Associates from its earliest days.

From Drafting Boards to Digital Design

The early 1980s saw a profound transformation across the American workplace, as desktop computers began appearing in offices nationwide. The engineering profession found itself at the forefront of this revolution. For decades, engineers had relied upon the same fundamental tools that their predecessors had used since the 19th century: pencils,

T-squares, triangles, and drafting tables. Engineering drawings were painstakingly rendered by hand on translucent sheets of Mylar, with every line, dimension, and notation carefully lettered by skilled draftsmen. Revisions meant erasing and redrawing or, in cases of significant change, starting from scratch. The precision required was extraordinary, and the time investment was substantial: a single mechanical drawing for a complex building could take days—if not weeks and months—to complete.

The advent of computer-aided design (CAD) promised to revolutionize this centuries-old practice, but the transition proved far from smooth. Early CAD systems required significant capital investment, occupied considerable office space, demanded specialized training, and often frustrated users with the systems' limitations and frequent malfunctions. Yet, for Mueller Associates, which had built its reputation



There were computers stacked three-deep (side-by-side) in a very narrow alley, only wide enough for a chair at each. If someone was already using the computer closest to the aisle and someone else wanted to use one of the other computers farther back, the person in the aisle would have to stand up and move out of the aisle to let the new user in. Or maybe two people would need to get up and out if someone was headed to the computer farthest back from the aisle.

Paul Czajkowski



Shown here early in his Mueller Associates career, Paul Czajkowski has spent more than four and a half decades with the firm.

upon technical excellence and innovation, embracing this new technology was essential, even when the early results were mixed.

Cramped Quarters and Other Challenges

The technological transition of the 1980s brought both challenges and opportunities. The shift away from traditional hand-drafting was dramatic and, for many, emotionally challenging. Mueller Associates' first computers—Digital Equipment Corporation's VAX series machines—occupied a cramped space on the second floor of the new headquarters. Bob Marino, who joined Mueller in 1985, vividly recalled the firm's early computing efforts with Tandy Radio

Shack TRS-80 "microcomputers." These primitive computing experiences stood in stark contrast to the efficiency and precision that hand calculations and drafting had provided for generations. Yet Mueller's engineers persisted, recognizing that mastering these new tools would eventually transform their practice.

Marino, who had come to the industry because he "had a passion to draw," witnessed the transformation firsthand: "When I came to the firm, we had drafting boards at every single station, and Mylar, and pencils, and that's how we developed drawings." The move to computer-aided design represented not only a change in tools, but also a fundamental shift in how engineering drawings were conceived

and produced. Skills honed over years—the precise lettering, the clean line work, the artistic quality of hand-drafted plans—suddenly seemed destined for obsolescence.

Client-Driven Innovation

This technological evolution was driven mainly by client expectations. Mueller Associates found itself working to keep pace with architectural firms, which were typically the first to adopt new technologies. “They [architects] were at the forefront of all these technological changes,” Marino recalled. “They were doing CAD before we were.” The challenge for Mueller Associates was compounded by the fact that software developers initially targeted architects as their primary market, meaning that “the MEP [Mechanical, Electrical, and Plumbing] components of the software lagged,” according to Marino. Despite these hurdles, Mueller Associates remained committed to technological advancement—driven by their most demanding clients, who expected their engineering partners to match their digital capabilities.

This investment in technology extended beyond design tools. The firm’s growing expertise in computing led to unexpected opportunities in database management and information systems. For instance, at Aberdeen Proving Ground’s Edgewood Area, Mueller’s team developed and managed advanced databases for the U.S. Army’s Toxic and Hazardous Materials Agency (THAMA). These sophisticated systems, housed on UNIVAC computers, supported essential programs related to the control and decontamination of toxic and hazardous waste at Department of Defense installations. This work demonstrated how Mueller’s technical capabilities were evolving beyond traditional MEP engineering into broader technological applications.

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We would enter data into legacy software to calculate building heating and cooling loads. It would take more than a day to input the data. Then we would press a button at the end of the day and let the computer run overnight, since the program would take hours to perform the computations. We would come back the next day, fingers crossed, hoping the program didn’t glitch—which it did 50% of the time.

Bob Marino



Bob Marino at Mueller Associates in the late 1980s.

EXPANDING HORIZONS: NEW PARTNERSHIPS AND HEALTHCARE GROWTH

In 1982, Mueller Associates established another cornerstone relationship with **Georgetown University**, starting with the design of the Bunn Intercultural Center. This initial project sparked more than four decades of collaboration across hundreds of projects. Details of Mueller's longstanding partnership with Georgetown University can be found in **Chapter Four**.

The firm's portfolio continued to diversify with projects for the **National Institutes of Health**, resulting in a surge in healthcare-facility work throughout the Mid-Atlantic region. Notable commissions included designs for **Johns Hopkins Bayview Medical Center**, **Greater Baltimore Medical Center**, **Carroll County Hospital**, **Civista Medical Center**, **Frederick Memorial Healthcare System**, and **Wake Forest University Baptist Medical Center** in North Carolina (today Atrium Health Wake Forest Baptist). These healthcare projects required increasingly sophisticated environmental-control systems, as medical technology advanced and regulatory requirements became more stringent. Mueller Associates' engineers found themselves designing operating rooms with precise temperature and humidity requirements, laboratories handling hazardous materials, and patient-care areas demanding both comfort and infection control.

BURIED EXPERTISE: UNDERGROUND TANKS AND INVISIBLE EXCELLENCE

In 1987, Mueller Associates confronted an engineering challenge that many other firms might have deliberately avoided. When the Maryland State Highway Administration needed to relocate a fuel station to accommodate a new highway exit ramp near Columbia, Maryland, the project required moving an underground storage tank owned by the local utility, Baltimore Gas and Electric (BGE). A Mueller project manager pulled young Mechanical Engineer Paul Czajkowski aside with a warning: "Paul, this project involves an underground storage tank. There's significant liability with this—oil, gasoline, and environmental regulations. I don't want anything to do with it." Despite these reservations, the firm pursued—and won—the commission. And, what began as a single reluctant assignment, evolved into a decades-long specialized practice that distinguished the firm as a leader in environmental-compliance engineering.

The timing proved fortuitous. The U.S. stood on the eve of a sweeping environmental initiative. In September 1988, the U.S. Environmental Protection Agency (EPA) published *40 CFR Parts 280 and 281*, which govern underground storage-tank systems. The need was urgent: most underground tanks nationwide were at risk of leaking gasoline, diesel fuel, heating oil, and waste oil into groundwater, contaminating the environment.

The EPA's solution was dramatic. Unlike typical building codes that grandfather existing installations, these new regulations required tank owners to either upgrade or replace existing installations. To accomplish this expensive and time-consuming work, the EPA established a 10-year compliance window, taking effect on December 22, 1988, with a final deadline of December 21, 1998.

For Czajkowski, who had only recently earned his mechanical engineering degree, the BGE project became an intensive learning experience. "No one around me had any experience, and I didn't have any either," he recalled. He immersed himself in the technical requirements, including leak-detection systems, corrosion-protection methods, and spill- and overfill-prevention equipment. Czajkowski studied tank specifications, pipe fittings, valves, suction pumping, pressurized pumping, dispensing systems, fuel-island designs, normal venting, emergency venting, delivery from tanker trucks by gravity and by pumped fill, environmental monitoring, cathodic protection, secondary containment methods, anti-syphon protection, high-level shutoffs, and other system controls. He learned the basics of remediation protocols. He learned to distinguish among the densities and volatilities of fuels such as gasoline, diesel, and Numbers 2, 4, and 6 fuel oils.

He also worked on fuel stations using alternate fuels such as methanol (wood alcohol) and biodiesel. "These projects did not involve typical HVAC equipment," said Czajkowski. "This was a business area all of its own." It included underground and aboveground tanks and piping, various pumping configurations, environmental regulations, fire codes, and open-loop piping designs. Consumers were vehicle-fleet fueling, standby electrical power generators, heating fuel boilers, and waste oil storage. Internally, this field of work was called "Fuel Storage and Delivery Systems Design."

The learning curve was steep, but Czajkowski had what he called a "pick-and-shovel" mentality: the ability to distill complex technical information from regulations and industry products into practical, constructable contract drawings and specifications. When the next underground storage tank project arrived at Mueller, it went directly to Czajkowski. "I had one tank's worth of experience," he noted, "but that was a lot more than anyone else had."

Mapping Underground Infrastructure

That modest advantage quickly compounded. The Maryland Department of General Services contracted with Mueller Associates to bring all State Highway Administration facilities into compliance with the new regulations. The scope was extensive: every state highway maintenance facility, from Keyser's Ridge in Western Maryland, to Pocomoke on the lower Eastern Shore, to St. Mary's City in southern Maryland—any location with a fuel station for the fleet of salt trucks and maintenance vehicles that kept Maryland's roads operational.

Many of these facilities lacked accurate records and drawings of their underground storage tanks. To overcome this obstacle, Czajkowski developed a methodology: establish a benchmark, measure distances to key features along a single continuous string, then measure again in a perpendicular direction. Sketch the site layout from scratch, examine the manholes atop the buried tanks, and deduce, based on engineering judgment and standardized construction practices, where the underground piping most likely ran. The drawings he produced included carefully worded disclaimers, stating that the contractor would undertake hand excavation to locate existing infrastructure before bringing in a backhoe. He created an 11-by-17-inch template drawing, and wrote specifications from scratch, working directly

CEs Monitor Underground Storage Tank Regulations

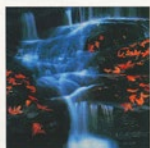
By PAUL F. CZAJKOWSKI and DANIEL L. RALEY

The U.S. Environmental Protection Agency (EPA) promulgated regulations in 1988 governing the design, construction, and installation of underground storage tank (UST) systems. These regulations, contained in Title 40 of the Code of Federal Regulations (CFR) Part 280, apply to many types of USTs, such as motor fuel and chemicals, while some types of USTs, such as residential, farm, and heating oil, are exempt.

The regulations require new USTs to meet specific performance standards at the time of their installation, including corrosion protection, spill/overflow prevention, and proper installation. Leak detection systems also must be provided at the time of installation. For existing USTs, there are three alternatives for compliance: adherence to new performance standards, upgrading (addition of interior tank lining, cathodic protection, or both, plus addition of spill/overflow prevention equipment), or closure.

One of these alternatives must be exercised by 1998. Deadlines for the provision of leak detection on existing USTs depend on the age of the tanks, and they range from 1989 to 1993, with the oldest tanks having the earliest deadlines. Existing USTs that cannot meet leak detection requirements by December 22 of the year in which leak detection is required must be closed.

The first step that UST owners should take to bring their facilities into compliance with the regulations is to have a facility audit conducted by a consulting engineering firm with experience in UST management. The purpose of the audit is to develop an overall management strategy. Some of the factors that must be considered include the age of the tanks, their expected remaining useful life, the proximity to regulatory



Various typical UST components are shown in this diagram, including the automatic tank gauging system, spill/overflow prevention valve, and automatic tank gauge.

deadlines, and the feasibility of usage or product changes in order to attain exemption from the regulations. A comprehensive strategy should be developed that considers regulatory requirements, technical feasibility implications, and least cost life-cycle evaluations.

For each method of achieving compliance, a variety of options is available. The optimum combination of options for a particular site can best be determined by qualified professionals who are well versed in the UST regulations and who have experience in designing new systems, upgrades/retrofits, and removals. Consulting engineering firms can provide guidance to UST owners regarding recommended options for a particular site and develop bid packages with plans and specifications to implement the recommended solutions.

It is essential that "real world," practical, and cost-effective solutions be proposed at this phase of the project. One way to help ensure this is to involve consultants in the study phase who are experienced in the design of UST upgrades/retrofits, removals, and installation. The UST regulations offer multiple options for compliance, and, to the untrained eye, all the options may

appear to be equally acceptable. However, some options might not be applicable at a particular site due to physical constraints, existing conditions, facility operational characteristics, or other factors. Experienced design engineers will be able to identify potential problems and "showstoppers" and rule out the impractical or impossible options early in the project, thus narrowing the scope to only the viable options.

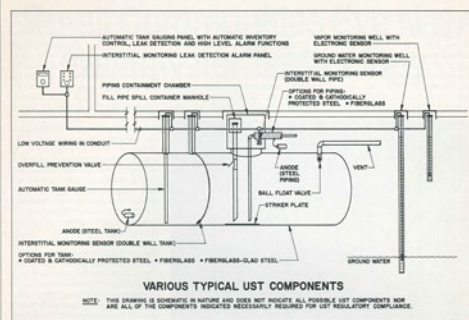
New Tank Options

New USTs must be equipped with leak detection, corrosion protection, and spill/overflow prevention at the time of installation.

Leak Detection. For new tanks, owners may choose between monthly monitoring and monthly inventory control combined with tank tightness testing every five years. The automatic tank

gauging, vapor monitoring, ground-water monitoring, and interstitial monitoring. If monthly inventory control combined with tank tightness testing every five years is chosen, it may be used for only 10 years after installation; then monthly monitoring must be used, requiring the addition of all necessary leak detection equipment.

For new piping systems, the requirements depend on whether the piping operates under positive pressure or suction (relative to atmospheric pressure). Pressurized piping systems must use automatic line leak detectors plus annual line testing or monthly monitoring. New suction piping systems must use monthly monitoring, line testing every three years, or meet no specific requirements if the system is designed to drain the product in the piping back to the tank if the piping develops a hole or rupture. Monthly monitoring methods



NOTE: THIS DRAWING IS GENERAL IN NATURE AND DOES NOT INDICATE ALL POSSIBLE UST COMPONENTS NOR ARE ALL OF THE COMPONENTS INDICATED NECESSARILY REQUIRED FOR UST REGULATORY COMPLIANCE.

testing, depending on age of the tank and whether or not a monthly monitoring method of leak detection is being used. Options available for existing piping corrosion protection are the same as for new piping. One additional option is to add a cathodic protection system for existing steel piping.

Spill/Overflow Prevention. Spill/overflow prevention must be provided for existing tanks by December 22, 1998. The options available for existing tanks are the same as those for new ones (spill/overflow prevention does not apply to piping systems).

Design Considerations. Consulting engineers should be aware that some states have UST regulations that are more stringent than EPA's. Furthermore, all UST regulations are subject to change at any time. For obvious reasons, it is important to start every project with an understanding of the most up-to-date regulations. There are subscription services available that can

be useful in keeping up with the latest changes in EPA and state regulations.

One of the first questions to be answered on any UST project should be "Are the USTs in this project regulated?" The EPA regulations exempt certain classes of underground tank/piping systems and defer certain requirements on other classes of USTs. If the USTs under a particular project are exempt or certain requirements are deferred, the owner should be made aware of what minimum requirements (if any) are applicable to his particular tanks.

The consulting engineer can guide the owner and should assist him in making decisions that are based not only on the minimum requirements of the regulations, but also on financial considerations and sound engineering judgments with respect to environmental issues. Decisions should be made with the understanding that UST regulations are subject to change and have become more stringent over the years.

Another important question that

should be answered early in the project is: "Does the UST store a hazardous substance?" The minimum requirements for hazardous substance USTs are more stringent than those for other types of tanks (such as petroleum USTs). Secondary containment with interstitial monitoring leak detection is mandatory when hazardous substances are involved, thus limiting the number of available options for leak detection. Non-viable options should be eliminated as early as possible in the project in order to streamline the design process.

A number of factors should be considered when determining whether an existing UST should be retrofitted/ upgraded or replaced. UST owners and consultants should bear in mind that in order for an existing UST to achieve long-term regulatory compliance (beyond 1998) the tank must be capable of retrofitted/upgrade for leak detection, corrosion protection, and spill/overflow prevention. These features must be provided for the tank and piping, except

that spill/overflow prevention is not applicable to piping. If an existing UST is not capable of retrofitted/upgrade for these features, it must be replaced or permanently closed. A field survey should take place at the beginning of a project, so that such determinations can be made. The following list represents some of the factors to consider when determining if an existing UST is a viable candidate for retrofit/upgrade:

■ **Existence of a Spans Tank Opening with Accessibility to Grade.** If there is no span port through which an in-tank probe can be permanently mounted, automatic tank gauging is not an option for leak detection. The technical feasibility and the cost implications of adding a span

port barrier or it is inaccessible (due to

senior) interstitial monitoring cannot be used for leak detection.

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By the time the EPA's 10-year compliance window closed in 1998, Mueller Associates had designed tank replacements and upgrades for more than 100 sites across Maryland.

Leadership and Technical Innovation

Within this complex niche area, Mueller Associates had developed specialized expertise that few consulting engineering firms could match. In Fall 1991, Czajkowski co-authored a technical article with Senior Project Manager Daniel Raley for *American Consulting Engineer* magazine, titled "CEs Monitor Underground Storage Tank Regulations." The article demonstrated the firm's thought leadership in this emerging field—not only in executing the work, but also educating the broader engineering community on regulatory compliance strategies.

By this point, Czajkowski had developed a comprehensive library of standard specifications—construction installation details for all system components, manhole configurations, pipe-fitting assemblies—that could be adapted to each site's unique conditions. "We literally used them on every tank project," he said.

This careful engineering of the standard details and specifications proved remarkably successful. These same fuel storage and delivery systems have now been installed for between 27 and 37 years. The firm has had no post-construction callbacks regarding a tank or piping failure, nor any citations of non-compliance with environmental regulations or fire codes.

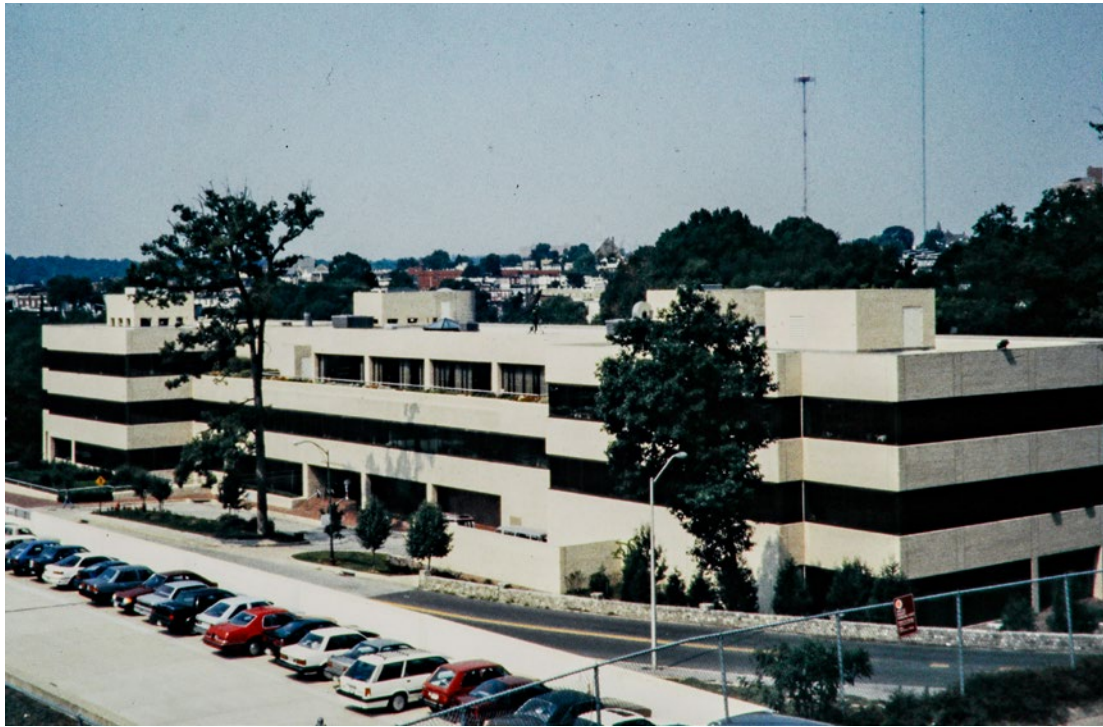
The Tank Commander's Legacy

Mueller Associates' work with fuel storage and delivery systems reflected its broader approach to engineering

challenges: identifying an emerging need that others might avoid, investing in the development of expertise, creating replicable systems and standards, and delivering work so thoroughly engineered that it requires no callbacks or corrections over decades of service.

Czajkowski spent several years of his Mueller career in groups related to the application of energy conservation and technology, before transferring to Mueller's mechanical division. The "tank work," as he called it, would become an unexpected cornerstone of his professional legacy, occupying one-half to three-quarters of his workweek for a decade, before he finally delved into traditional HVAC engineering design. "This was ten years of my life or more," he reflected. "I was known as the Tank Commander."

The irony was not lost upon him: although he had wished for more early-career HVAC experience, his willingness to tackle the challenge of designing fuel storage and delivery systems, when no one else would, made him indispensable to Mueller Associates during a critical period of growth and transition. It was engineering so successful that it remained invisible, and quietly protected Maryland's groundwater for generations to come.



The Space Telescope Science Institute on the Johns Hopkins University Homewood Campus, following its opening in the mid-1980s. Mueller Associates engineered the precision systems supporting the facility, which would serve as the operational nerve center for both the Hubble Space Telescope and the James Webb Space Telescope.

ENGINEERING FOR THE COSMOS: THE SPACE TELESCOPE SCIENCE INSTITUTE

The early 1980s brought Mueller Associates face to face with humankind's most challenging endeavor: Space exploration. In what must have seemed like destiny for a firm born during the Space Race, Mueller Associates engineered the mechanical, electrical, and plumbing systems for the **Space Telescope Science Institute** (STScI) on Johns Hopkins University's Homewood Campus.

This project, completed in two phases in 1984 and 1986, was more than just another institutional building. The 125,000-square-foot, six-level facility serves as the nerve center for NASA's Hubble Space Telescope (HST) and James Webb Space Telescope (JWST) missions. Both have

revolutionized our understanding of the Cosmos. In addition to HST's ongoing science operations, and scientific exploration with JWST, launched in 2021, STScI manages and operates the Mikulski Archive for Space Telescopes (MAST), established in 1990, which contains data from many active and legacy missions. The staff at STScI includes scientists (mostly astronomers and astrophysicists), spacecraft engineers, software engineers, data-management personnel, education and public outreach specialists, and administrative and business support staff.

Precision Engineering for Discovery

The technical challenges involved in engineering the STScI were significant. Adding to this, the facility housed the world's most advanced computer and photographic processing equipment, which required adherence to stringent environmental conditions. Collaborating closely with NASA and Science Operations Ground System (SOGS) personnel, Mueller's engineers designed sophisticated HVAC systems for cleanroom environments, with precise temperature and humidity controls to safeguard sensitive equipment.

The stakes were extremely high. A power outage or environmental change could endanger invaluable astronomical data. Mueller's engineers responded by conducting thorough reliability assessments of both the power and HVAC systems, ultimately designing backup systems to maintain operations during equipment failures. The firm also considered alternative communication links, including microwave and dedicated cable systems, to bypass (via alternative routes) the traditional infrastructure, ensuring uninterrupted data flow. Although the facility needed exceptional reliability, it also required energy efficiency. Mueller's engineers developed an innovative approach, using a heat-recovery chiller to heat the building and process water. This forward-thinking solution further showcased the company's growing expertise in sustainable design.

When completed, the STScI represented both a technological achievement and a philosophical milestone for Mueller Associates. The firm, which had begun with modest projects in suburban Baltimore in 1966, during the height of the Space Race, was now developing systems to support humankind's exploration of the Cosmos. In subsequent decades, STScI would broaden its mission beyond Hubble to include other astronomical initiatives, continuing the



Exterior view of the Space Telescope Science Institute's Steven Muller Building, viewed from San Martin Drive.

discovery process that Mueller had helped enable through its engineering expertise.

This project, perhaps more than any other in the 1980s, demonstrated how the commitment of Mueller Associates to technical excellence and innovative problem-solving could contribute to achievements that exceeded conventional engineering. As Richard Mueller had envisioned from the beginning, the firm was addressing challenges that truly mattered—in this case, helping to unveil the secrets of the Universe itself.



A CULTURAL RENAISSANCE: THE NATIONAL MUSEUM OF WOMEN IN THE ARTS

Another significant project during this era was the transformation of a 1908 Classical Revival building in downtown Washington, D.C., into the **National Museum of Women in the Arts** (NMWA). The historic structure, originally built as a Masonic Temple, had served various purposes over nearly eight decades, before its acquisition by the Museum's founders. With its grand columned façade, marble interiors, and ornate architectural details, the building presented both an opportunity and a formidable engineering challenge.

This commission proved particularly significant for Bob Marino, then a recent Penn State graduate, who worked alongside Gene Nerf to master the intricacies of renovating the historic building. The project required Mueller's engineers to design a sophisticated HVAC system capable of

maintaining the precise environmental conditions necessary for preserving priceless works of art—stable temperature, carefully controlled humidity, and air filtration to protect against pollutants—all while respecting the building's historical fabric.

"The challenge of designing a museum HVAC system within a historic building ignited my passion for this business," Marino would later reflect. The technical complexities were substantial: modern mechanical systems needed to be threaded through spaces never intended to accommodate ductwork, piping, or equipment. Every penetration through historic walls or ceilings required careful consideration. Equipment had to remain accessible for maintenance, while also remaining invisible to visitors in the galleries.

to that specific building contributed significantly to the project's success. More information on NMWA is shared in **Chapter Eleven**.

The NMWA project also exemplified the mentorship culture that Richard Mueller had established from the outset. Young engineers did not just receive assignments—they worked alongside experienced professionals who taught them not only technical skills, but also the problem-solving approach, client relationships, and professional judgment that defined the company's practice. This commitment to developing talent ensured that Muller Associates' engineering excellence and client-service philosophy would endure across generations.

CELEBRATING TWO DECADES OF EXCELLENCE

Mueller Associates reached a significant milestone in 1986, marking 20 years of service. What began as a four-person firm with annual billings under \$70,000 had grown into a powerhouse, with more than 100 employees, generating more than \$5.5 million annually—placing it on *Engineering News-Record's* list of Top 500 Design Firms. This remarkable growth reflected the company's unwavering commitment to the founding principles established by Richard Mueller: delivering high-quality services, projects, and staff.

In the company's newsletter, Richard Mueller, reflecting upon the journey, emphasized that, although 20 years of service might mean different things to different people, the word "service" held special significance for him. He took pride in how the firm had "translated our pursuit of quality into a significant services practice," transforming from its humble beginnings into a respected presence.

Mueller's reflections also revealed a deep appreciation for his firm's evolution, and its people. He noted that early institutional projects had helped cement the company's reputation for quality. The addition of prestigious clients—the Lyric, BMA, and Smithsonian, for example—further enhanced this standing. Mueller expressed particular satisfaction that the firm's original principles—quality engineering projects delivered with technical excellence, at fair fees—had remained unchanged, even as the company expanded significantly in size and scope. Mueller also honored the firm's exceptional staff—particularly Gene Nerf who, with 20 years of service, was the company's longest-tenured employee, and had risen from draftsman, to vice president, and now division director.

Although Richard Mueller focused primarily on his company's humble origins, company President Andrew Parker looked toward the future. He shared Richard Mueller's commitment to these foundational values, while acknowledging the need for strategic evolution. Parker stated that growth for growth's sake had never been an objective. However, he also understood that the firm's 40% increase in staff over the previous two years reflected genuine market demand and client needs. He anticipated significant organizational changes to accommodate this growth, including the continued decentralization of technical-production responsibilities, and the streamlining of administrative functions. Importantly, Parker emphasized the firm's commitment to providing career advancement opportunities, ensuring that staff knew that "they can progress at Mueller—that their jobs are not dead-ended."

The firm's technological evolution was equally forward-looking. Parker predicted that Mueller Associates' high-tech reputation would drive continued changes, with increased use of personal computers and CAD. He viewed these

technological advances not as disruptions, but as tools that would “improve the quality of the work we do for our existing clients,” while opening up new markets and service offerings.

Geographical expansion represented another key element in the firm’s growth strategy. During the previous two years, Mueller Associates had established an associated office in Ottawa, Canada, through the formation of Sypher: Mueller International Inc., and had opened a branch office in Falls Church, Virginia, to better serve the Meridian Corporation and the DOE’s renewable energy program. While Parker firmly stated that the corporate headquarters would remain in Baltimore, he acknowledged that the “expansion of the firm to other branch office locations, in order to better support our growing national presence, seems certain.”

In a personal reflection that captured the essence of the corporate culture at Mueller Associates, Parker described working at the firm as a rare opportunity to realize his professional capabilities, while “doing what I enjoy most and having fun.” Parker particularly valued his 14-year collaboration with founder Richard Mueller, praising Mueller’s technical abilities, competence, ethics, and personal charisma.

This sentiment echoed Mueller’s own thoughts about the anniversary milestone. “To me,” he said, “20 years of service means a happy, prosperous, and personally rewarding brief period of my career. I’d do it all again.”

Parker concluded that “that kind of personal experience and co-worker chemistry is available to others at [Mueller], as they are able to develop it in similar relationships in their own time”: a philosophy that would continue to define the firm’s approach to both service and employee development.



MUELLER ASSOCIATES, INC.
Consulting Engineers

NEWSLETTER

VOLUME III NUMBER 1J. Brantley, EditorFALL 1986

Reflections on 20 Years of Service

by Richard P. Mueller, P.E.,
Chairman of the Board

“Twenty years of service” is a phrase that means different things to different persons: a long time to some of our young draftspersons; less of a span to some of us who are older. The word “service” is the part of the phrase that I would like to reflect upon with you.

Mueller Associates, Inc. was founded upon the principles of quality services, quality projects, quality clients, and quality staff. We’ve translated our pursuit of quality into a significant services practice. The Firm, which started with four persons and billings under \$70,000 annually, now numbers 100 and boasts annual billings exceeding \$5.5 million, which places it in the *Engineering News-Record’s* (ENR) Top 500 Design Firms.

Early on, the Firm chose as its primary market institutional, owner-occupied buildings. Projects such as the North Arundel Hospital, Monumental Life Insurance Company, the Washington Cathedral, and the C & P Telephone Company established MAI’s reputation for quality. The Baltimore Museum of Art, the Lyric Theatre, the Baltimore



Wife Eileen reaches out to hug Gene Nerf at his “twenty years of service” ceremony. Andrew Parker smilingly looks on.



Andrew Parker (l.) and Richard Mueller congratulate Gene Nerf (r.) and his wife, Eileen.

A Glimpse into the Future

by Andrew J. Parker, Jr., President/CEO

A president is never satisfied with the way things are—regardless of how good they are. To see an example, all one need do is to reflect on Mueller Associates’ 20-year history and note the many changes which our founder and first president, Richard Mueller, implemented—always after careful deliberation. I am no different.

The Firm has recently reached several significant milestones: gross sales

ing religiously to these principles established the Firm’s reputation as one of the best consulting engineering firms in the Baltimore/Washington area. These MAI characteristics will not change.

I do anticipate, though, changes to MAI’s organizational structure. While “growth for growth’s sake” has never been an objective, our staff size has increased about 40 percent during the past 2 years. This change is in response

Yet, even as Mueller Associates marked 20 years of engineering excellence, significant challenges lay ahead. Richard Mueller’s retirement within two years would set in motion a corporate acquisition that would threaten the firm’s culture and force its leaders to make difficult choices about its future.



CHAPTER 4

A Decade of Transition and Renewal

The late 1980s marked a turning point in the history of Mueller Associates, driven not by failure, but by the complexities of succession planning within a close-knit professional services firm. After more than two decades of building his company into a respected engineering practice, Richard Mueller confronted a challenge that many successful entrepreneurs of his generation faced: how to ensure its continuity as he prepared for retirement.

Unlike larger corporations with established stock-ownership structures and a clear succession track, Mueller Associates lacked a viable transition plan. For all of Richard Mueller's visionary leadership in building an engineering firm known for technical excellence and client service, he had not adequately prepared for the issue of who would lead the firm after him. The company's growth had been entirely organic. Mueller maintained a controlling interest alongside other minority stockholders, such as Gene Nerf. But the capital structure and distribution of internal ownership did not enable the next generation to buy out the company's founders.



The South Edgewood Street headquarters bearing the EA Mueller name. From 1988–1992, the building that Richard Mueller had built also carried someone else’s sign, a fact that weighed heavily upon the engineers who worked inside.

As Bob Marino later recalled, “The firm had grown. We were very successful, very profitable, and the older owners of the firm were at a point in their careers where they needed a transition into retirement.” This growth, ironically, made the challenges around succession more acute. The firm’s value had grown substantially, but the younger engineers who might have taken the reins lacked both the financial resources to acquire the company, and the stake in ownership needed to facilitate a gradual transition. As Richard Mueller contemplated his retirement in the late 1980s—two decades after acquiring ENSERCO—the options were limited and imperfect: either develop a complex internal succession plan requiring years of significant financial engineering, or find an external buyer who could provide both immediate liquidity for the retiring owners and, theoretically, stability for the firm’s future.

THE EA ENGINEERING YEARS

In 1988, Richard Mueller made what appeared, at the time, to be a prudent business decision. EA Engineering, Science, and Technology, Inc., a large national environmental engineering firm with offices across the country, acquired Mueller Associates.

Founded in 1973 and headquartered in Hunt Valley, Maryland, EA had grown rapidly through acquisitions and organic expansion, establishing itself as a major player in environmental consulting and remediation services. With annual revenues in the tens of millions, and hundreds of employees nationwide, EA represented the kind of corporate stability and resources that seemed ideally positioned to support Mueller’s continued growth.

“We found out that a much larger national firm had acquired us,” Marino recalled many years later. “They were local, but they had offices all over the country. It seemed like a good marriage, because it offered Mueller an opportunity to expand its geographical reach.”

For EA Engineering, the acquisition afforded access to Mueller’s rapidly growing technology divisions—particularly its expertise in environmental and energy systems, which aligned naturally with EA’s existing infrastructure and business model. These specialized divisions emerged from Mueller Associates’ pioneering work in solar energy systems and environmental engineering during the 1970s and early 1980s, largely thanks to Andrew Parker’s visionary leadership. By the late 1980s, these divisions represented nearly two-thirds of Mueller Associates’ staff, and had helped secure the firm’s most lucrative contracts with federal government agencies. They embodied the cutting edge of digital innovation and advanced design capabilities: precisely the assets that made Mueller Associates attractive to EA Engineering’s strategists.

However, this corporate logic resulted in an inherent mismatch. What had made Mueller Associates exceptional from its founding—the mechanical, electrical, plumbing, and fire-protection engineering and design that had built the firm’s reputation—held less strategic interest for EA. The building-systems design division, which Richard Mueller had nurtured with such care, and which had established the firm’s identity, was now a secondary consideration within EA’s larger corporate structure.

Because of these difficulties, the relationship lasted only a few years. “There was some friction between the firms,” Marino noted. “Their [EA] philosophy on how they did work, and how they treated clients, was a lot different than ours.”

Richard Mueller later recalled the period with characteristic frankness: “EA’s style was so different from our management style and personnel policies. We lost many good people. Morale hit bottom.”

This incompatibility in corporate culture extended beyond management philosophy to fundamental questions about what mattered most in professional practice. EA’s priorities—scaling operations, standardizing procedures, maximizing efficiency across divisions—clashed with Mueller Associates’ founding principles of customized client service, technical excellence on complex projects, and long-term institutional relationships. For a firm that had built its reputation upon engineers who knew what their clients looked like, and understood each building’s unique challenges, a more conventional corporate approach clashed with everything Richard Mueller had worked to create.

The Costs of Incompatibility

The impact on the Mueller workforce was immediate and painful. Valued employees left, institutional knowledge walked out the door, and the personalized service culture that had distinguished the firm began to erode. For those who remained, such as Marino, the period marked an unsettling departure from what had initially drawn them to Mueller Associates. The passion and dedication Gene Nerf exemplified—qualities that had attracted talented engineers to the firm—seemed increasingly out of place within EA’s corporate structure.

By 1992—as the cultural disconnect had become increasingly apparent and the misalignment of Mueller’s building-systems division with EA’s core business had become undeniable—EA decided to divest itself of its engineering operations. This decision, which could have

marked the end of the Mueller Associates story, instead created an unexpected opportunity, ultimately revitalizing the firm, and returning it to its founding principles. “The acquisition, and the recovery after that, were pivotal,” Marino later said, recognizing how close the firm had come to dissolution.

A Lesson in Continuity

Yet even in this moment of crisis lay the seeds of a more resilient future. The EA Engineering experience would prove costly, but invaluable for institutional continuity. When Richard Mueller and Gene Nerf worked to reclaim the firm in 1992, they would do more than restore the Mueller Associates name: they would fundamentally restructure how the company prepared for leadership transitions.

Never again would the firm’s future depend upon a single founder’s retirement decisions, or be vulnerable to acquisition by an incompatible corporate parent. The reconstituted Mueller Associates would build something that Richard Mueller’s original vision had lacked: a deliberate succession framework with diversified internal shareholders, ensuring that the next generation of leaders would have both an ownership stake and the financial means to guide the firm’s destiny. This commitment to forward-thinking succession planning would become as fundamental to Mueller’s identity as its technical excellence. It was a lesson learned through near dissolution that would secure the firm’s independence for decades to come.

RECLAIMING THE LEGACY

On April 13, 1992, Mueller Associates returned to private practice as Mueller Associates II, or MAII, a temporary name

used to circumvent the firm’s prior recognition until it could divest itself of the unsuccessful merger with EA. For Richard Mueller, the chance “to reestablish the company as the quality company it had been before its buyout” proved compelling enough to bring him out of a short-lived retirement. At the same time, Gene Nerf faced a crucial decision about the future of the engineering-design division. As Marino remembered: “Gene decided that we would either totally dissolve that part of the company, or he would re-acquire it, bring in a couple of other key people, and keep that core group together. We were confident that we could reestablish our relationships with our clients.”

To return once again to its proud history of engineering excellence, the reconstituted Mueller Associates II required exceptional leadership. Having weathered the EA years, Gene Nerf had been considering his next move when a fortunate alignment of circumstances occurred. “At the end of my contract with EA Mueller, I was thinking about my options,” said Nerf. “It just so happened that Gary Johnson, a long-time friend and very prominent individual within the local engineering community, was thinking about his future at the same time.” Johnson had worked with Richard Mueller at another engineering firm, before Mueller purchased ENSERCO. The three men—Mueller, Nerf, and Johnson—shared a deep commitment to hands-on personal service: a philosophy that had been a Mueller Associates hallmark before the acquisition.

Following the dissolution of the partnership with EA, Gene Nerf became Mueller Associates’ third president, and Johnson joined as a principal and vice president. Richard Mueller returned and served as principal-in-charge of quality control, his name and presence becoming, in his words, “the physical manifestation of what we are trying to proclaim to the industry”: that the firm had returned to its roots.



From left: Alexander Petrlik, Gary Johnson, Richard Mueller, and Gene Nerf, pictured in 1992, the year they reestablished Mueller Associates. The reconstituted leadership would quickly rebuild the client relationships and institutional trust that had defined the firm's first quarter-century.

Alexander Petrlik also joined the leadership team. Another Johns Hopkins University engineering graduate, he had worked alongside Nerf at EA, and was now appointed a principal, and vice president of administration and marketing. As Petrlik reflected: "Becoming Mueller Associates II was a tremendous opportunity. We got to handpick our staff [when we separated from EA Engineering]. We picked outstanding people who shared our ideas of excellence."

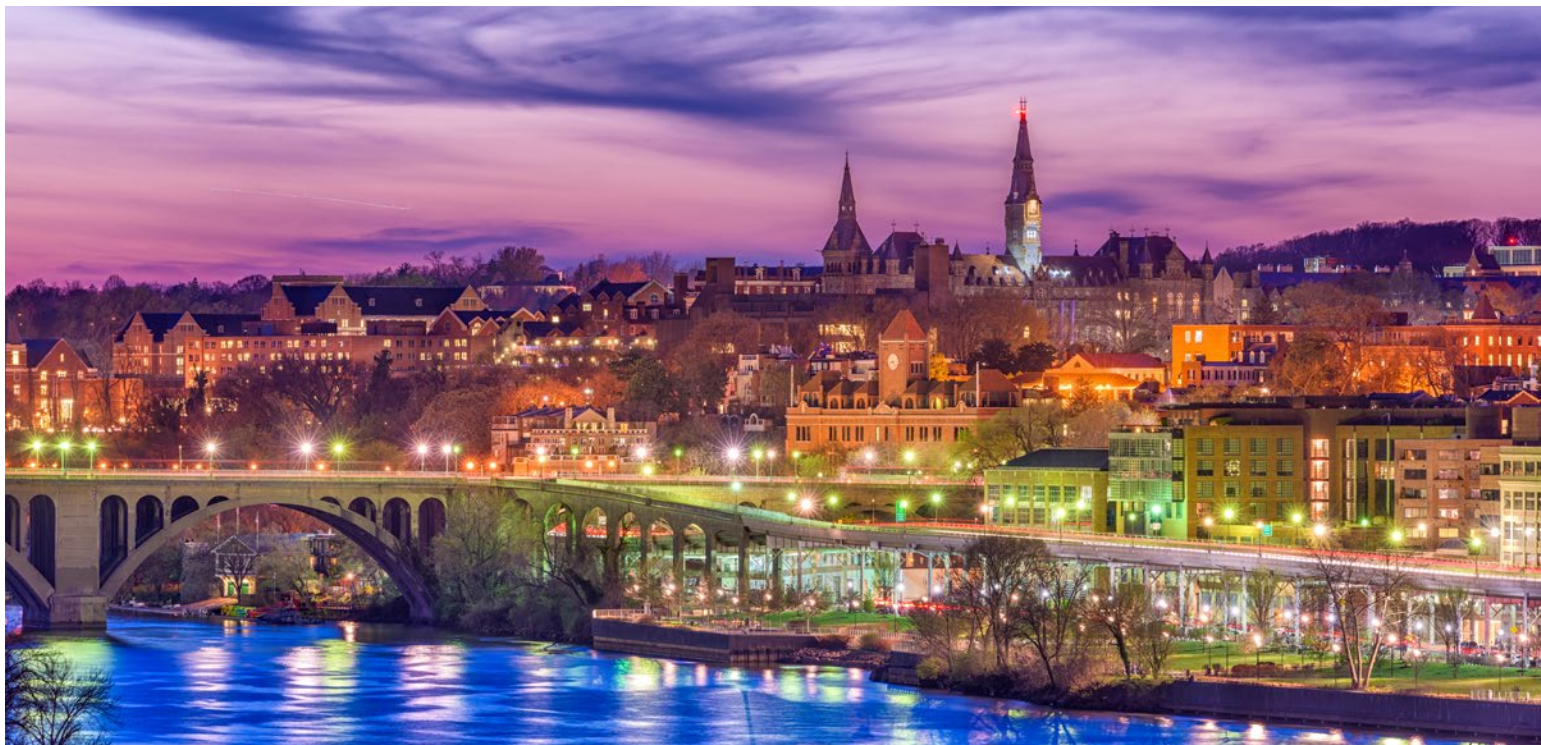
Each principal brought unique strengths to the restructured firm. Richard Mueller contributed his founding philosophy and invaluable expertise in building systems: experience that proved especially useful for the firm's renovation and retrofitting projects. Johnson added his vision and

extensive experience with complex institutions. Petrlik offered his business acumen, enthusiasm for challenging projects, and specialized engineering background. Most critically, Nerf provided the leadership energy needed to keep the firm focused on delivering high-quality work, thus helping to restore the company's reputation for engineering excellence.

Rebuilding Trust

The new leadership team brought a fresh focus to instilling confidence in the marketplace, along with personalized customer service. Shortly after the rebuild, Richard Mueller observed, "We're now getting to the point of being the preferred engineer on many of the projects that we respond to." Johnson added, "We are also working closely with clients that each of us has nurtured over the years. All of our clients know what we look like." Nerf was clear about the firm's priorities, moving forward: "I don't believe growth for growth's sake is important." Perhaps most significantly, the leadership team made a forward-looking commitment to the firm's future. "It's our goal to eventually turn the ownership of the business over to our younger people," Petrlik promised. It was a commitment that would be honored in the subsequent decades.

The reconstituted Mueller Associates began with just 26 employees. By 1995, however, Nerf noted that, "Growth has not been in numbers, but in the confidence of the firm's clients, and the work which those clients are contracting." The firm quickly reestablished itself, securing significant projects with both new and repeat clients, demonstrating that it had not only weathered the EA Engineering interlude, but had also emerged with a renewed focus on the technical excellence and client service that had been its hallmark since the beginning.



ENGINEERING THE FUTURE OF A CAMPUS: GEORGETOWN UNIVERSITY

When Mueller Associates began its relationship with **Georgetown University** in 1982, designing mechanical and electrical systems for the new **Bunn Intercultural Center**, few could have predicted that this initial collaboration would evolve into one of the firm's most enduring institutional partnerships. For more than four decades, Mueller's engineers have helped transform the infrastructure of America's oldest Catholic university, enabling its growth while navigating the constraints of its historic urban campus.

The University's story starts with Archbishop John Carroll, who, in 1789, obtained the deed to land on a hilltop overlooking the village of Georgetown, then a busy tobacco port in Maryland. Carroll, named the first head of the Catholic

Church in the United States, envisioned an institution that would be "the mainsheet anchor" of American Catholics: a school blending the best of Catholic and democratic traditions through a Jesuit liberal arts education. The first student, future Congressman William Gaston, enrolled in November 1791, and classes began in January 1792 with just two students. By June of that year, enrollment had grown to more than 40 students, from as far away as the West Indies.

The University faced significant challenges in its early years, including financial difficulties and the devastating impact of the U.S. Civil War, which reduced enrollment from 313 in 1859, to 17 by 1861. However, Georgetown University

persisted and gradually grew, adding professional schools of medicine in 1851, and law in 1870.

By the mid-20th century, under leaders like Father Edward Bunn, S.J., the University underwent remarkable growth, establishing the School of Business Administration in 1957, and admitting women for the first time in 1969. The 1980s marked another era of expansion, with the completion of the Yates Field House and the opening of the Bunn Intercultural Center: buildings that also signaled the start of Mueller Associates' lasting partnership with the University.

Foundation Built Upon Strategic Planning

In 1994, Mueller Associates' relationship with the University took a decisive turn when Georgetown's facility executives approached the firm to assess the aging central chiller plant, in order to develop both short- and long-term infrastructure improvements. This comprehensive evaluation served as the foundation for a master utility plan that continued to influence campus development for more than three decades. "Our approach was to look beyond immediate needs to anticipate the University's direction," recalled Gary Johnson, who served as Mueller's principal-in-charge for many of the early Georgetown projects. "We wanted to create a roadmap that would support Georgetown's ambitions, while respecting the realities of an urban campus with limited possibilities for expansion."

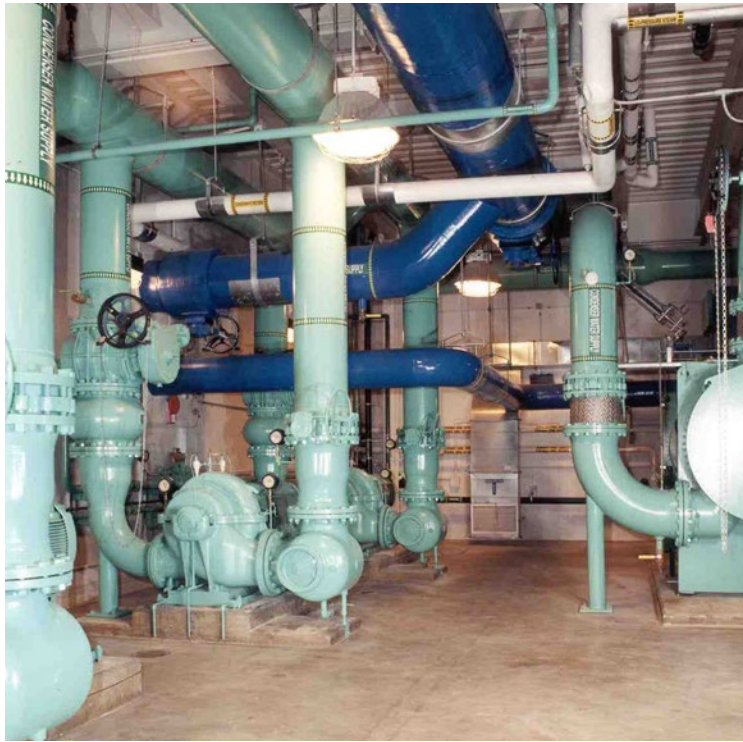
The University's prominent location in Northwest Washington, D.C., posed significant challenges for infrastructure planning. Given the limited space for expansion, and a campus comprising more than 50 buildings spread out over 104 acres at the time, creative solutions were necessary. Mueller Associates' 1994 feasibility study proposed not only improvements to the existing central chilled

water plant, but also innovative strategies to enhance the system's refrigeration capacity within its current footprint. "We advised removing the University's old wooden cooling towers, located at grade level, and converting the perimeter brick walls that screened them into a new plant addition, which now accommodates the chilled-water generating and electrical equipment," said Johnson. "We were able to work within the existing brick envelope, which was vital to the success of the project, and to the overall phasing of the improvements." This approach exemplified the firm's goal of maximizing existing resources while planning for growth.

Phase I: Modernizing the Central Plant

The first phase of the central plant's construction, completed in 1998, increased the plant's capacity to 12,000 tons, while allowing the University to maintain much of its functioning equipment. "Some of the equipment was dated, but it was still running well for the time being," said Steven Gillis, who served as project manager and lead mechanical engineer on these initial projects; he has since overseen all the firm's work at Georgetown for more than two decades. "We wanted to optimize their systems," he added, "and provide the most cost-efficient approach, while utilizing the older equipment for standby or peak-sharing operations."

For Gillis, the appeal of working on Georgetown's central plant extends beyond technical complexity. "What makes it exciting is the scale. It's a relatively large central utility plant that serves more than five million gross square feet of building space within the campus, so it's much bigger than just a standalone building system," he says. "The approach to engineering a central plant plays a significant role in providing cost-effective, reliable, and efficient cooling and heating service to the campus buildings. Operating costs for the campus, and maintenance costs, are greatly affected by



Beginning with a feasibility study, Mueller Associates developed a long-term roadmap, implemented over more than two decades, for modernizing Georgetown University's central chilled-water plant.

the design and selection of equipment and related components within the central plant.”

Institutions of higher education, such as Georgetown University, present unique engineering challenges requiring specialized expertise. “When designing systems for higher-education institutions, our engineers get exposed to the full gamut of building system types, because such institutions are essentially mini-cities,” Gillis has observed. “From this in-depth experience designing building systems for higher-education institutions, we can optimize the design of central plant systems, knowing that it’s paramount to consider reliability, maintainability, temperature setpoints, a building’s environmental constraints, and system selections that maximize the return on investment.”

Phases II–V: Continuous Evolution at the Central Plant

As Georgetown University has continued to grow, the services of Mueller Associates have been repeatedly requested. In 2002, the University commissioned another plant upgrade: a two-phase project designed to increase capacity by 4,000 tons. The firm’s approach maximized the existing footprint by installing three 3,000-ton chillers. These replaced two outdated steam-turbine chillers without expanding the plant’s floor area or disrupting campus services. By 2005, the second central plant project was operational and, in 2009, Mueller Associates would engineer the addition of a 3,700-ton chiller. The firm’s thorough understanding of Georgetown’s systems proved invaluable in 2010, when it developed an electrical master utility plan,



Through five major phases of improvements, Mueller Associates expanded and modernized Georgetown University's central plant within the campus' constrained urban footprint.

followed by the replacement of the satellite chilled-water plant and an upgrade of the electrical infrastructure on the east campus. The relationship continued with a fourth central-plant project in 2014, adding a new deaerator and boiler feedwater system to replace equipment nearing the end of its useful life. By 2015, Mueller Associates had completed a fifth plant project: an ambitious expansion of the central chilled-water plant, which included a 3,700-ton duplex chiller addition, the replacement of two 1,600-ton cooling towers with three 2,570-ton cooling towers, and a new 480-volt electrical-distribution network.

“Over the years, our challenge has been to replace and upgrade aging equipment within the footprint of the central plant,” says Gillis. “The planning process requires vigilance to be sure that we’re focusing on the most efficient solution.

Energy efficiency, minimizing maintenance, and developing designs that avoid utility disruptions are key.”

Mueller’s design philosophy across all its projects—especially its work on central plants—is forward-thinking. “As we approach every project, we’re always looking toward the future, including growth, and upcoming codes and standards,” Gillis notes. “We’re always trying not to design to the minimum code efficiencies that are adopted today, but are instead always looking to the future, because one day those codes will actually be adopted as the new minimum requirements. Our design philosophy is to exceed the minimum efficiency standards established by the codes, not to the point that it becomes excessively costly, but instead to provide the best value for that particular project.”



PRESERVING GEORGETOWN'S CULTURAL HERITAGE: THE BOOTH FAMILY CENTER FOR SPECIAL COLLECTIONS

The Joseph Mark Lauinger Library has anchored Georgetown's main campus since 1970, when it replaced the historic Riggs Library as the University's primary research facility.

Designed by renowned architect John Carl Warnecke, who also created the John F. Kennedy Eternal Flame at Arlington National Cemetery, the six-story building was conceived as a contemporary complement to Georgetown's historic architecture. Warnecke's Brutalist design drew deliberate inspiration from the campus' Flemish Romanesque Healy Hall and the Gothic Revival Copley and White-Gravenor Halls, incorporating their "undulating exterior wall surface and profusion of vertical elements" via an irregular outline and pronounced vertical emphasis.

The library's iconic spire echoes Healy Hall's clock tower, while its dark gray granite-aggregate exterior harmonizes with surrounding campus buildings. Construction began in 1967, and the library opened to students on April 6, 1970. Named in honor of Lieutenant Joseph Mark Lauinger, a 1967 alumnus who was killed in the Vietnam War, the library received the AIA Award of Merit in 1976 for its distinguished accomplishment in library architecture.

Nearly half a century after its opening, Georgetown engaged Mueller Associates to address environmental challenges within this culturally significant space. The **Booth Family Center for Special Collections**, located within the Lauinger Library, houses approximately 150,000 rare and historically significant printed books, dating from the 15th century to

the present day, along with extensive manuscript collections in political science, diplomacy, American and European history, literature, and Jesuit education.

The University's archives—established in 1816, making Georgetown one of the first American colleges to create such a repository—hold materials as early as 1786. Among the treasures requiring protection are documents dating back to the 1830s from the University's original library, rare Victorian novels, African-American literature and imprints, and essential works documenting Jesuit history and American Catholic education.

Modernization of the Lauinger Library's Booth Center presented unique engineering challenges, which demanded Mueller Associates' specialized expertise in historic preservation and archival environments. The project required stringent environmental controls to protect irreplaceable materials, which are highly sensitive to fluctuations in temperature and humidity. Paper-based materials, which constitute the majority of the collection, physically change shape in response to fluctuations in humidity, and repeated temperature and humidity variations cause structural damage over time.

Precision in Preservation

For the Booth Center project, Mueller Associates designed a sophisticated heating and cooling system, along with fire-suppression systems—all engineered to maintain precise environmental conditions. Archive and library environments require temperature stability within $\pm 2^{\circ}\text{F}$, and relative humidity between 30% and 50%: standards that are more stringent than conventional building requirements. The challenge extends beyond achieving these parameters: the systems must maintain strict levels continuously, 24 hours

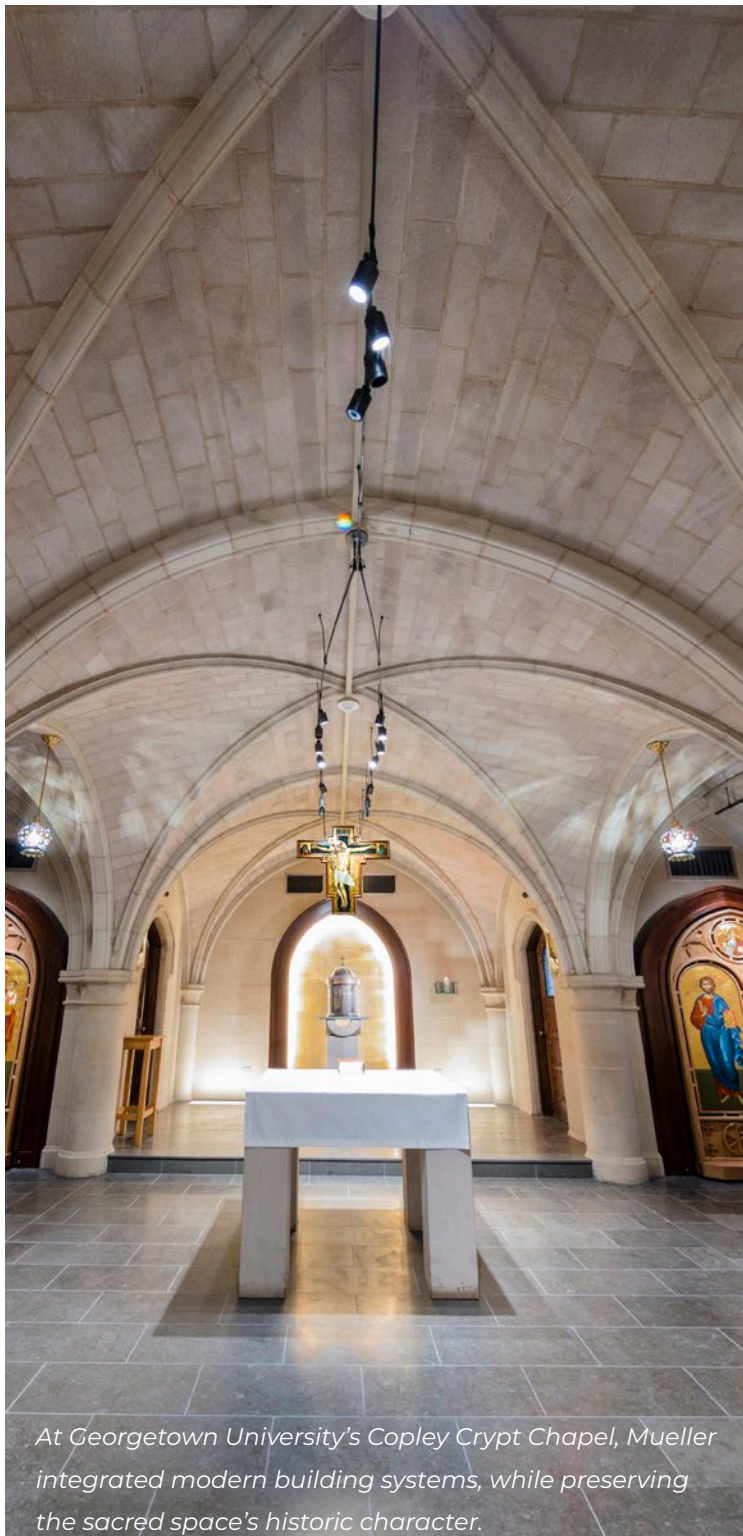
a day, year-round, to prevent the growth of mold, chemical deterioration, and physical degradation that threaten priceless historical materials.

Environmental controls and secure shelving now protect the collection's rare and fragile resources. The 7,000-square-foot Booth Center includes classroom spaces, a reading room, a reception area, exhibition areas, and a collaborative workspace for faculty and students. The renovation modified, improved, and expanded the existing mechanical, electrical, and plumbing systems to suit the renovated spaces, dramatically enhancing the preservation environment for special collections.

This project exemplifies Mueller's understanding that educational institutions encompass "the full gamut of systems," as Gillis notes, requiring engineers to "design special environmental systems" in which "stringent and reliable temperature controls" are paramount. For spaces housing cultural treasures, the engineering stakes extend beyond comfort or efficiency; the work directly affects whether irreplaceable pieces of history will survive for future generations.

HONORING SACRED SPACES: ENGINEERING FOR WORSHIP AND REFLECTION

In 2021, Mueller Associates applied its expertise to two of Georgetown's most historic and sacred spaces. Set in the basement of Copley Hall on the Georgetown University campus, the **Copley Crypt Chapel** opened in 1932, and is used for liturgical services and weekly Catholic mass. The **St. William Chapel**, located directly above the Copley Crypt Chapel on the Hall's first floor, is a slightly larger space that accommodates services, weddings, and other events.



At Georgetown University's Copley Crypt Chapel, Mueller integrated modern building systems, while preserving the sacred space's historic character.

Mueller completed engineering upgrades for the facilities in two phases, replacing the existing HVAC system, updating lighting and lighting controls, and modifying electrical distribution. Additional improvements included interior and exterior renovations, ramp reconfigurations to improve accessibility, and the restoration of windows, flooring, stained glass, and roofing. Mueller's team carefully routed piping beneath the stone walls and floors in the crypt, to minimize impact on the historic structure. The systems were also designed to be as quiet as possible, allowing for prayer and meditation.

PLANNING AND EXECUTING GEORGETOWN'S MAJOR CAMPUS EXPANSION

As Georgetown prepared for its most significant expansion in years—the 477,000-square-foot **MedStar Georgetown University Hospital Medical/Surgical Pavilion**—Mueller Associates was once again called upon to develop a Master Utility Plan. Completed in 2016, it outlined sustainable measures to enhance and expand the central plant's capacity, flexibility, reliability, and capability, meeting chilled-water and steam requirements in both the short and long term.

"Mueller's expertise in the field, and their knowledge of Georgetown University, have really helped us over the years—they are very thorough in their solutions," said Xavier I. Rivera Marzán, former Director of Utilities & Energy Programs at Georgetown University. "Their team has a strong ability to create engineering solutions that meet our needs in terms of schedule, budget, and working with the existing plant site."

Completed in 2025, Mueller's work supporting the MedStar Georgetown University Hospital Medical/Surgical Pavilion

brought this ambitious vision to life. Mueller expanded the central utility plant on the University campus to accommodate significant new utility loads from MedStar's new pavilion. The massive infill project added 156 private patient rooms, 31 operating rooms, and 32 exam rooms in a new emergency department.

Key components of the central utility plant expansion included a new 3,700-ton duplex chiller; a 100,000 pounds-per-hour high-pressure steam boiler; and ancillary pumps, boiler feedwater equipment, water treatment, electrical upgrades, and miscellaneous upgrades to the plant's monitoring and control systems. The campus chilled-water piping, campus steam-distribution piping, and campus electrical-service feeders were also modified and extended to support expansion of the central utility plant, the new pavilion, and future campus development.

REPLACING WHAT WE BUILT: A FULL-CIRCLE MOMENT

By 2025, Mueller Associates found itself in another unique position: replacing infrastructure it had designed three decades earlier. The firm led two significant infrastructure upgrades to Georgetown University's central utility plant, supporting campus growth and needs, while also promoting energy efficiency and meeting sustainability goals.

The first project involved replacing several cooling towers and their associated condenser water pumps. The cooling towers have a total nominally rated heat-rejection capacity of 13,000 tons, to serve electrically driven centrifugal chillers in the central utility plant. The original three 3-cell, 3,000-ton cooling towers, and two 2-cell, 2,000-ton cooling towers were replaced with three 3-cell, 4,470-ton cooling



I find the experience at Georgetown University very satisfying and personally rewarding. I started working with them in the mid-1990s, and we've been developing and maintaining a relationship with Georgetown's facilities group ever since. Even as things have changed, we've been able to maintain that relationship. It's because of our great experiences with them, the project successes that have been achieved, and just listening to what Georgetown's needs are—that's paramount.

Steven Gillis

towers. The second project involved replacing an existing 2,000-ton chiller with a new 3,700-ton electric motor-driven centrifugal chiller. The existing cooling towers and chillers being replaced were designed by Mueller and installed in 1995: a testament to both the longevity of well-designed infrastructure, and the enduring nature of the Mueller-Georgetown partnership.

The collaborative approach between Mueller and the University has evolved and deepened over more than four decades. Mueller has helped Georgetown University build for the future, while honoring its past.

For an institution founded in 1789 that continues to evolve in the 21st century, this blend of historical understanding and future-oriented thinking has proven to be the perfect engineering partnership.



PRESERVING AMERICA'S TREASURES: THE WINTERTHUR MUSEUM, GARDEN & LIBRARY

Following its return to independence after dissolving its partnership with EA Engineering, Mueller Associates needed to prove that its engineering excellence had not only moved past the transition, but remained as robust as ever. The **Winterthur Museum, Garden & Library** projects would provide exactly that proof.

These were not merely another set of commissions. They were complex, multi-phase engagements with one of America's most prestigious cultural institutions, requiring technical sophistication and a meticulous attention to detail that would test any engineering firm. That Mueller Associates secured and successfully executed these projects, so soon

after leaving EA, spoke volumes about the confidence that clients placed in the firm's capabilities, as well as the caliber of work the reconstituted team could deliver.

From Gunpowder to Grandeur

The story of the Winterthur Museum begins not with a building, but with a vision rooted in the profound legacy of American industrial achievement and cultural preservation. The du Pont name, which would become synonymous with both American industry and cultural stewardship, traces its origins back to 1802. In that year, Éleuthère Irénée (E.I.) du Pont founded a gunpowder company at the Eleutherian

Mills on Brandywine Creek near Wilmington, Delaware—two years after his family had fled France to escape the French Revolution and religious persecution of the Protestant Huguenots.

Between 1810 and 1818, E.I. du Pont purchased the property where Winterthur now sits, initially for farming and the raising of sheep. In 1837, his heirs sold 445 acres to his French business partner, Jacques Antoine Bidermann, and Bidermann's wife, and E.I.'s daughter, Evelina Gabrielle du Pont. Between 1839 and 1842, they built a 12-room Greek Revival manor house, and named their estate Winterthur, after Bidermann's ancestral home in Switzerland. What began as a small gunpowder mill would evolve into one of America's most influential chemical companies, fundamentally shaping not only Delaware, but the very fabric of American industrial development.

By the time Henry Francis (H.F.) du Pont inherited the Winterthur estate in 1927, his family's industrial empire had already established itself as a cornerstone of American innovation, having developed numerous polymers and chemicals in the early 20th century. The company's commitment to scientific research and innovation proved to be more than just an industrial legacy; it informed H.F. du Pont's approach to developing what would become America's premier museum of the decorative arts. This prominent antiques collector and horticulturist transformed his inherited family estate into an unprecedented American cultural institution.

Du Pont tripled the manor's size and outfitted it with architectural elements salvaged from 17th- to 19th-century American homes, including wood interior paneling from historic residences. With rooms themed by time period, this was no mere collecting hobby, but a systematic effort to

preserve American craftsmanship and cultural heritage at a time when industrialization was rapidly transforming the United States.

A National Authority

The Museum that H.F. du Pont established in 1951 reflected both his family's scientific precision and his personal passion for American decorative arts. Winterthur has been called the "largest and richest museum of American furniture and decorative arts in the world." With some 50,000 objects from sconces to spatterware, displayed in hundreds of period installations—all of them adorned with panels, moldings, and cornices salvaged by du Pont from old buildings—Winterthur seemed preeminently "the bastion of decorative arts connoisseurship in America," as *Museum News* triumphantly expressed it in 1977.

The historical significance of Winterthur extends far beyond its impressive collection. First Lady Jacqueline Kennedy invited du Pont to chair the Fine Arts Committee, providing advice on the 1961–1963 renovation of the White House. This recognition positioned Winterthur not merely as a repository of American decorative arts, but also as a living authority on American design and craftsmanship: a role that would make the museum's environmental-preservation systems critical to the nation's cultural heritage.

Engineering Excellence on Display

Against this backdrop of industrial innovation, cultural preservation, and national significance, Mueller Associates would demonstrate its renewed capabilities through a series of challenging and prestigious projects at Winterthur. In 1993, the firm finalized the engineering design for a new 47,000-square-foot Exhibition Building and connecting



Gene Nerf examines existing mechanical systems at Winterthur Museum. These projects demanded the kind of engineering that Mueller Associates had refined through decades of cultural institution work, protecting irreplaceable period rooms assembled from historic properties across the Eastern Seaboard.

foyer. This project highlighted the firm's ability to integrate sophisticated environmental control systems within architecturally sensitive spaces. The engineering challenges were noteworthy: the new Exhibition Building was constructed on the site of the existing chilled-water plant that served parts of the Museum, Research, and Conservation Buildings, requiring careful planning and phasing to maintain operations.

Mueller's engineering solutions were both innovative and practical. The firm's designs expanded the existing plant by adding two 300-ton centrifugal chillers, and refurbishing a 270-ton centrifugal machine. New cooling towers, pumps, and piping-distribution systems were designed to enhance operational efficiency and reliability, both of which were crucial for a facility housing priceless collections.

Two factory-fabricated air-handling units, with a combined capacity of nearly 70,000 CFM, included high-efficiency air filters, preheat and cooling coils, supply and return air fans, sound attenuators, and low-pressure steam-grid humidifiers. All building HVAC systems were managed by a Direct Digital Control (DDC) automatic temperature control system—an emerging technology that was adopted by Mueller Associates early on.

Hidden Systems, Priceless Finishes

Mueller Associates' relationship with Winterthur deepened in 1995, when the Museum sought to conduct a comprehensive study and upgrade the environmental-control systems in the historic main museum building. This project posed extraordinary challenges that went far beyond typical

museum work. Bob Marino, who played a significant role in this project, described the unique nature of the challenge: “This was a mansion. Therefore, it wasn’t designed for a museum-quality environment, and lacked effective vapor barriers. It had single-pane glass windows throughout. We worked very closely to not only provide an environment that was acceptable for maintaining these artifacts, but one that would be stable, and one that the building envelope could appropriately sustain.”

The existing systems consisted of two-pipe induction units, with the piping on the brink of failure due to a lack of water treatment for approximately 40 years. Even more daunting, the Museum’s period rooms were constructed with priceless finishes that concealed units in need of replacement.

The environmental-control requirements demanded creative compromise. “We collaborated with their curators to determine the temperature and relative humidity requirements,” said Marino. “Although the Museum desired a stable indoor relative humidity of 50% year-round, we could not achieve that setpoint during the winter months in Delaware without risking condensation on windows, or potential damage to the building’s infrastructure and exhibits. We compromised by designing to a reduced but stable [real humidity] setpoint of 35% in the winter, and gradually transitioned between summer and winter relative humidity [RH] setpoints.”

The Mueller Associates team also developed a detailed phasing plan that enabled careful documentation and removal of room façades, replacement of induction units, and flushing and cleaning of existing piping risers—all while maintaining temperature and humidity controls. This precision in an occupied historic structure further demonstrated the firm’s ability to work with complex, cultural, and historic institutions.

Additionally, the project involved numerous other MEP upgrades to improve reliability and operating efficiency, including expansion of the 400-ton chiller plant by 250 tons; the addition of a cooling tower equipped with a water-side economizer control; replacement of office-wing fan-coil units with a central-station, variable-air-volume air-handling system; upgrade of the electrical power distribution system, and replacement of existing diesel generators.

In 1995, a final phase upgraded the boiler plant from a heating-only system to one capable of both heating and producing humidifying steam. Three cast-iron sectional boilers were replaced with three 150-horsepower flexible water-tube boilers, and a deaerator and auxiliary equipment were added to support the institutional boiler plant. To ensure that the Museum’s collections remained protected, Mueller’s team developed a plan that included pre-purchasing equipment, fast-tracking construction, and using a temporary boiler to maintain steam service.

Excellence Restored

The Winterthur projects were a declaration of the revival of Mueller Associates. These technically demanding, multi-phase projects at a premier cultural institution demonstrated that the engineering excellence cultivated by Richard Mueller had not only moved past the EA interlude but had also emerged stronger and more focused.

The complexity of maintaining museum-quality environments within historic structures, the precision required to work behind priceless period room finishes, and the sophisticated phasing needed to protect irreplaceable collections—all of this demanded exactly the kind of meticulous attention to detail, institutional expertise, and trust that had defined Mueller Associates from the very beginning.



A LEGACY OF CULTURAL PRESERVATION: THE WALTERS ART MUSEUM

Following its successful reestablishment, Mueller Associates secured another significant cultural and institutional relationship with the **Walters Art Museum** in Baltimore. Beginning in 1994, this partnership ultimately spanned more than two decades, and encompassed close to 20 projects.

The Walters Art Museum is one of Baltimore's—and America's—preeminent cultural institutions, housing a collection spanning more than seven millennia of artistic achievement. Founded by father-and-son collectors William T. Walters and Henry Walters, the Museum began as a private collection amassed in the late 19th and early 20th centuries.

William Walters, who prospered in Baltimore's wholesale liquor trade and railroad industry, collected European art

while living in Paris during the U.S. Civil War. His son Henry expanded the collection dramatically, acquiring Ancient Egyptian, Greek, and Roman art; medieval ivories and illuminated manuscripts; Renaissance bronzes; and masterworks spanning cultures from Asia to the Americas.

Upon Henry Walters' death in 1931, the entire collection of more than 22,000 items—along with the Museum buildings and an endowment—was bequeathed to the City of Baltimore “for the benefit of the public.”

Today, the Museum's collection comprises 36,000 objects representing cultures from around the globe, from 5000 BCE to the 21st century, making it one of the few institutions in America to present such a comprehensive overview of world art under one roof.

The physical presence of the Walters Art Museum also reflects Baltimore's architectural evolution across more than a century. The distinctive Palazzo building, located at 600 North Charles Street, opened in 1909, and was modeled after a 17th-century palace in Genoa, Italy. Its dramatic appearance reflects the grandeur of Henry Walters' vision. The newer Centre Street building, constructed in 1974 in the Brutalist architectural style, was designed to accommodate the Museum's growing collection and its need for expanded exhibition space, and houses additional galleries, art-making studios, an auditorium, a café, and a gift shop. The elegant Hackerman House (located at One West Mount Vernon Place)—a restored 19th-century mansion—houses the Walters' Asian Art collection.

What makes the Walters Art Museum particularly significant for engineering specialists like Mueller Associates is the institution's recognition that its buildings are themselves works of art, and the most significant objects in its collection—a philosophy that demands the highest standards of environmental control and preservation. The Walters' mission to provide free admission to all visitors, maintained since 2006, adds another layer of complexity, as systems must accommodate large numbers of visitors, while maintaining the strict environmental conditions required for artifact preservation.

Beginning with Understanding

Mueller Associates' first project at the Walters was a comprehensive assessment of the Museum's buildings, and would set the foundation for years of collaboration. A 1994 study provided a detailed evaluation of the Museum's 1974 Centre Street building, including its mechanical, electrical, and plumbing systems. This initial commission identified critical improvements needed to protect the Museum's

world-renowned collections, and laid the groundwork for the extensive renovations that followed.

For Todd Garing, a young engineer who had joined Mueller in 1993, this initial study marked the beginning of a career-defining relationship with the Walters—and his passion for cultural work with museums. Recalling his early tenure, Garing said, "I started out by helping Gene Nerf on at the Walters Art Museum. It began just as a study, to try to figure out what to do there." He added, "I grew up at Mueller in that project [the Walters]. I started as an engineer. I was promoted from project engineer to project manager. And by the time it was done, I was a stockholder."

The Centre Street Transformation

The flagship project in Mueller's partnership with the Walters was the Centre Street Building renovation, a multi-phase modernization that transformed the 94,000-square-foot, 1974 facility. Completed in 2001, this ambitious undertaking encompassed a conservation laboratory, a new south entrance atrium, and renovations to the lower level of the historic 1909 North Charles Street building.

The complexity of this undertaking became apparent as the project evolved from a study to a full-scale renovation. It presented extraordinary logistical challenges, due to its phased occupancy during renovation. "They had to maintain conditions in the galleries while we replaced the chiller plant," Garing recalled. "We came up with temporary work plans to move things, renovate that area, and move things back. It was quite interesting."

The architectural integration proved equally complex. According to Garing, "There was ductwork embedded in the floors that we integrated and reused. One architectural

challenge was improving interior wayfinding, which required creating large openings between the two buildings. Of course, this is where most of the large vertical duct mains were located. Our design required new duct routing, new shafts, and unique ideas to work collaboratively with the architects and solve all of these problems.”

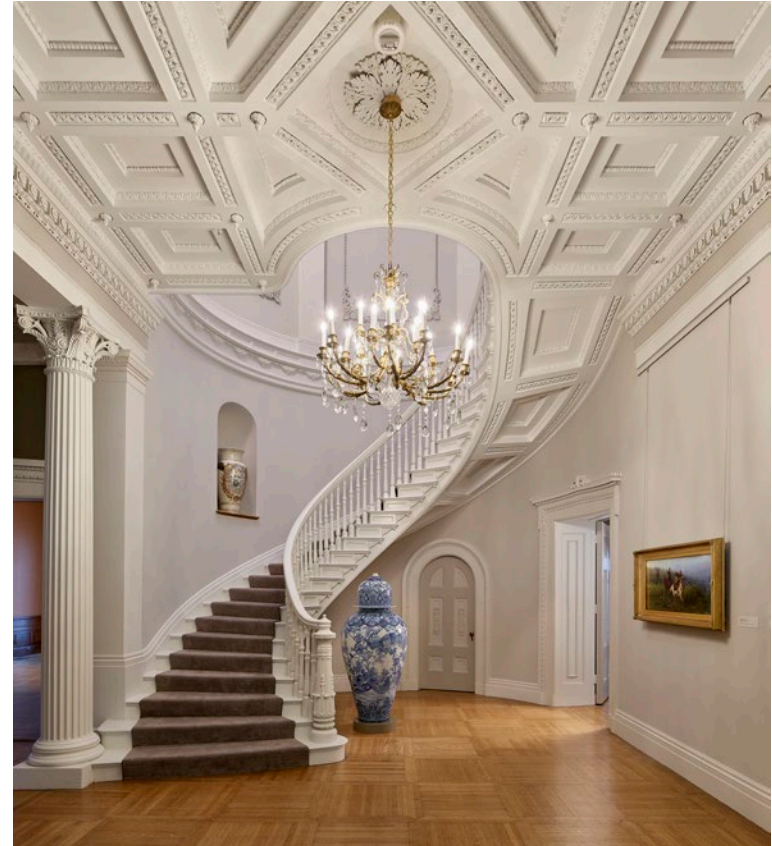
The technical challenges of the Centre Street renovation required innovative solutions to fundamental infrastructure problems. The existing system had suffered from poor zoning and failing components. Mueller’s solution demonstrated creative problem-solving under extreme constraints.

EXPANDING THE PARTNERSHIP

Mueller’s work extended throughout the Museum’s interconnected buildings, each presenting unique preservation challenges. The **Hackerman House** and **Carriage House** renovations in 2002 created 6,000 square feet of semi-permanent exhibit space, necessitating careful modifications to air devices, sprinkler heads, lighting fixtures, and receptacles, to accommodate the new layouts while maintaining strict environmental controls.

The comprehensive **One West Mount Vernon Place** renovation, completed in 2018, demonstrated Mueller’s growing sophistication in historic preservation. This 19,300-square-foot, four-story renovation of the 1850 Hackerman House (Thomas-Jencks-Gladding House) required upgrading MEP systems throughout the building, while respecting the limitations of the historic structure.

The Walters Art Museum projects further established Mueller Associates as a leader in museum environmental systems, demonstrating the firm’s ability to balance the



Mueller's work at the Hackerman House exemplified the firm's growing expertise in historic preservation, where every engineering decision had to honor both the building's architectural integrity and its priceless contents.

competing demands of preservation, accessibility, and operational efficiency. For the engineers who worked on these projects, they also represented career-defining experiences that shaped their professional development. As Garing reflected, “When you have these kinds of projects at a specific moment in your career, they always resonate with you. [...] You really feel a sense of pride and satisfaction.”



CHAPTER 5

Entering the New Millennium

The turn of the 21st century brought both strategic reassessment and visionary leadership to Mueller Associates, under the guidance of Gene Nerf, who had been serving as the firm's president and chairman since 1992. Having witnessed both the firm's founding era and its turbulent rebirth after the EA Engineering period, Gene possessed not only a deep understanding of Mueller Associates' technical foundation, but also hard-won insights into the importance of maintaining independence, nurturing client relationships, and building institutional resilience.

In 2000, under Gene's leadership—and with guidance from Alex Petrlik, vice president of marketing and business development—the firm enlisted industry consultants to conduct a comprehensive assessment of Mueller Associates' business-development efforts and how the market perceived the firm. This strategic review reflected Gene's methodical approach to positioning the firm for future growth.

The audit affirmed what Nerf had been building toward for years: Mueller Associates had regained its reputation for delivering quality results and specialized expertise. More significantly, the assessment highlighted an unexpected competitive

advantage: clients particularly valued the firm's professional demeanor and collaborative approach. The review also prompted a thorough rebranding effort, encompassing a new logo, a redesigned newsletter titled *Momentum*, and a new website highlighting the firm's expanding portfolio. These changes reflected the evolution Gene had been orchestrating since taking over almost a decade earlier, transforming Mueller Associates from a local and regional engineering firm into a leader when it came to complex institutional projects requiring stringent environmental controls.

Leadership Through Mentorship

As someone who had risen from draftsman, to design division director, to president, Gene brought both deep technical knowledge and business acumen to his leadership role. His expertise with facilities in challenging environments—museums, performing arts centers, hospitals, laboratories, and historic structures—positioned Mueller Associates at the forefront of specialized institutional work. “Gene had always emphasized that engineering excellence wasn't enough,” said Bob Marino, who had been working closely with Nerf since joining the firm in 1985. “You had to understand the client's vision and work as partners, not just consultants.” This philosophy, instilled by Gene throughout his tenure as president, had now become an integral part of the firm's identity.

Throughout his presidency, Gene demonstrated a remarkable commitment to developing the next generation of leaders. His relationship with Bob Marino reflected this approach. In the early 1980s, when Gene and Richard Mueller visited Penn State University to interview students, they weren't just recruiting; they were identifying future leaders. As Marino recalled: “Sitting there talking to these two gentlemen, who collectively had 60 to 70 years

of experience in engineering for buildings, and just their passion for what they did. [...] They just seemed to love their job. They'd been doing it for decades. That resonated with me.”

Under Gene's guidance, Marino developed his passion for museum projects, understanding that building the company's portfolio was the first challenge. But, Gene's mentorship extended far beyond technical training. He guided Marino through the firm's evolution, involving him in major projects, including significant work at several institutional campuses. This led to a period of remarkable growth and innovation under Gene's presidency.

Foundations Beyond Buildings

Throughout the early 2000s, Gene demonstrated that technical excellence alone was insufficient to sustain a specialized engineering practice. Having experienced firsthand the disruption of the EA Engineering acquisition, he understood that the firm's future depended upon deep, resilient client relationships, built upon trust and consistent delivery. Rather than pursuing every available project, Gene focused the efforts of Mueller Associates on institutional clients with complex, ongoing needs—universities, museums, performing arts centers, and healthcare facilities—where the firm's specialized expertise in environmental controls and systems integration could create lasting value.

The **Smithsonian Institution** remained a cornerstone client, with projects that showcased the firm's expertise in complex environmental-control systems.

At the **John F. Kennedy Center for the Performing Arts**, the renovation, in the early 2000s, of the Family Theater resulted in more than 35 projects for Mueller across the venue. Each



Gene Nerf at his desk in the early 1990s, shortly after leading the buyback from EA Engineering and reestablishing Mueller Associates. The firm that Nerf had joined as its second employee in 1966 had returned to its roots.

required the type of careful coordination that had become Gene's hallmark: maintaining the Center's demanding performance schedule, while upgrading essential building systems. Gene's hands-on approach and problem-solving abilities made him particularly valued by clients facing complex technical challenges.

At **Duke University**, Mueller engineered the first of several new buildings on the prestigious campus, establishing a new standard for sustainable design in academic health-care and science facilities.

This relationship with Duke grew directly from Mueller Associates' earlier partnership with Wake Forest University School of Medicine in Winston-Salem, North Carolina. The firm's exceptional work transforming office space into research laboratories, and later engineering the medical school's extensive power plant expansion, had established Mueller's reputation within the local academic and medical communities.

ENGINEERING THE FUTURE OF HEALTHCARE EDUCATION: WAKE FOREST UNIVERSITY SCHOOL OF MEDICINE

When **Wake Forest University School of Medicine** contacted Mueller Associates in March 2001 with a unique request, it marked the beginning of a significant partnership. The medical school needed to swiftly transform the top two floors of a corporate office building into state-of-the-art research laboratories: a demanding task in any scenario, but one complicated by an expedited ten-month timeline.

“Laboratory conversions are among the most technically demanding projects we undertake,” said Marino, who, at the time, served as director of operations and as project manager for the initial Wake Forest assignment. “You’re essentially transforming a space designed for one purpose into something with entirely different infrastructure requirements: ventilation, plumbing, power, and safety systems. Add in the compressed schedule, within an occupied building, and you have a genuine engineering challenge.”

From Labs to Legacy

Mueller Associates’ engineers began with a comprehensive feasibility study of the mechanical and electrical infrastructure for the 43,000-square-foot space at One Technology Place. Constructed in 1999, the building was conveniently located near the medical school’s main campus; however, its systems were designed for corporate offices, rather than the rigorous demands of medical research. Mueller’s assessment confirmed that the conversion was viable, prompting an innovative design-build approach to compress what would typically be an 18- to 20-month project into less than a year. “Usually we work within a design/bid/build structure,” Marino said at the time, “where the contractor bids and builds the project according to its own completed design documents. Using the design/build method, the design and construction activities overlapped, allowing the project to be completed within a much shorter time.”

One strategic decision proved particularly effective: fast-tracking the procurement of major equipment. Custom rooftop air-handling equipment—with a 16-week fabrication schedule—was designed and ordered at the outset of the project, ensuring that it would be ready when needed, despite the compressed timeline. “In the beginning, it seemed like an impossible task: to pull such a complex

project together in less than one year,” Marino reflected. “But the results proved that it was not only possible, but very successful.”

As Wake Forest enhanced its reputation as a nationally recognized academic medical center and health system—offering clinical expertise in more than 100 specialties, and serving as the region’s sole Level 1 trauma center—Mueller Associates’ role grew accordingly.

The Master Plan Emerges

A significant phase in the medical center’s growth involved planning for a freestanding cancer hospital, scheduled to open in early 2014. Anticipating this major campus expansion, administrators engaged Mueller Associates in 2006 to develop a Master Utility Plan, and explore enhancements to the circa-1969 power plant. This central facility supported the four-million-square-foot campus with chilled-water and steam-generation and -distribution systems, with piping routed to buildings via an extensive utility-tunnel network.

The initial phase of the Master Utility Plan involved integrating a 4,800-ton condenser water system with an existing 14,400-ton system: a complicated undertaking that required replacing three 933-ton chillers with three 1,600-ton chillers.

From the initial laboratory conversion, to an extensive power-plant expansion supporting a burgeoning academic medical center, Mueller Associates demonstrated both technical expertise and a deep understanding of engineering for healthcare-education environments. The projects completed for Wake Forest reflected a partnership built upon trust, innovation, and a shared commitment to improving medical care and research.



TAKING CENTER STAGE: THE JOHN F. KENNEDY CENTER FOR THE PERFORMING ARTS

In the world of the performing arts, the **John F. Kennedy Center for the Performing Arts** is a global cultural beacon that also serves as America's living memorial to its 35th president. Authorized by Congress in 1958 as the National Cultural Center, and later renamed to honor the slain president, the Kennedy Center opened its doors in 1971, as both a living memorial to President Kennedy, and as the nation's premier cultural institution.

Designed by architect Edward Durell Stone, the Modernist landmark extends 630 feet along the Potomac River. Its distinctive white marble façade and soaring columns create an iconic silhouette within Washington's skyline. The

building houses multiple world-class venues: the 2,400-seat Concert Hall, home to the National Symphony Orchestra; the 2,300-seat Opera House, which hosts the Washington National Opera and American Ballet Theatre; the 1,100-seat Eisenhower Theater; and several smaller performance spaces. Since its opening, the Kennedy Center has welcomed more than 400 million visitors.

As the nation's busiest performing arts facility, the Kennedy Center presents approximately 3,500 performances annually, ranging from Broadway musicals and world premieres to intimate chamber music recitals and experimental theater productions. Its stages have witnessed historic moments:

presidential galas, ceremonies celebrating lifetime achievements in the arts, and countless performances that have shaped American cultural life for more than five decades.

The Center's role extends far beyond entertainment; it also serves as a diplomatic stage, an educational hub, and a reflection of America's artistic values to the wider world. Within this context of cultural significance and operational complexity, maintaining and enhancing the Kennedy Center's infrastructure requires not only technical expertise but also a profound understanding of the institution's mission, and the exacting standards necessary to support world-class performances.

Behind the majesty of this landmark lies an engineering partnership that has spanned decades, affecting nearly every corner of the sprawling complex. Mueller Associates' partnership with the Kennedy Center is a prestigious collaboration, spanning more than 35 ambitious capital projects, renovations, and infrastructure improvements.

The Family Theater

Mueller Associates' journey with the Kennedy Center began in 2006, with renovation of the Family Theater. This project transformed a film theater into a state-of-the-art venue for live performances. The 324-seat space presented several engineering issues. "It was extremely challenging to accommodate the new air-handling equipment and ductwork within the theater's existing infrastructure," recalled Darren Anderson, project manager for Mueller. "At the same time, we had to meet the requirements of the architect and the acoustical engineers regarding the layout."

Working alongside RCG Architects, Mueller's engineers mapped pathways for mechanical systems, where

seemingly no space existed. Every inch was precious; every systems component had to be precisely placed to avoid compromising either the Theater's functionality or its acoustical integrity.

The renovation was so successful that Kennedy Center staff invited the design and construction team to a special viewing of the Theater's first performance after the renovation: a play called *Alice*, starring Whoopi Goldberg.

The Eisenhower Theater

In 2008, following their success with the Family Theater, Mueller Associates was engaged to renovate the Kennedy Center's 1,100-seat Eisenhower Theater. Collaborating with Quinn Evans, Mueller addressed mechanical issues that had long troubled the venue. "The HVAC improvements were critical to the success of this project," says Todd Garing, Mueller's project manager for the renovation. "They [the Kennedy Center] had difficulty with the existing system, in that the air currents from the air handlers blew directly onto the scenery. When they turned off the system, it got very hot on the stage. We resolved all of that."

The solution required both technical expertise and creative thinking, with systems that needed to be "tightly packaged, because the new system could not interfere with the rigging," explained Garing. In a theater where scenery flies in and out during performances, and every cubic inch of space serves a purpose, the engineering had to be both flawless and invisible.

The comprehensive renovation enhanced sightlines for patrons, improved accessibility, and upgraded sound, lighting, and mechanical systems. Larry Barr, principal-in-charge for Quinn Evans, described Mueller's holistic approach:

“Both the electrical and the mechanical work for this project were very challenging. Mueller modified and re-routed the ductwork within an extremely tight space. This was a very sophisticated system, and it required a lot of coordination.”

The project’s success also demonstrated Mueller’s ability to bridge engineering precision with architectural sensibility. “Mueller thinks as we do,” Barr said. “They ask the right questions, and they can address the technical challenges. They understand the importance of their work to the overall success of the theater.” This integrated design perspective, cultivated since Richard Mueller’s early insistence that mechanical systems should enhance rather than compromise architecture, proved essential for spaces in which technical performance and aesthetic integrity were equally critical, like in the Eisenhower Theater.

Infrastructure Upgrades

In 2009, Mueller Associates undertook a critical behind-the-scenes project, leading a comprehensive investigation of the existing electrical-distribution system and equipment rooms throughout the Kennedy Center. This study analyzed the electrical systems and provided recommendations to upgrade the distribution equipment, improve system coordination and functionality, enhance safety through an arc-flash hazard analysis, and address code deficiencies. Although invisible to the visitors who come to the Center each year, these infrastructure improvements laid the essential foundation for all performances and activities within the iconic building.

The Theater Lab

In 2010, Mueller Associates tackled renovation of the 12,000-square-foot Theater Lab, the venue’s only



The Eisenhower Theater at the Kennedy Center following the renovation. Working within an extremely tight space, Mueller’s engineers modified and re-routed the ductwork to enhance sightlines, improve acoustics, and upgrade mechanical and lighting systems, all without compromising the Theater’s architectural integrity.

experimental theater space. The project completely reoriented the stage and seating areas, increasing capacity from 350 to 400, while creating one of the most intimate and unique theaters at the Kennedy Center.

The firm’s approach balanced preservation with innovation. Meticulous coordination with the existing structure was necessary for the engineering design. Exposed ducts and air-handling devices were designed to be unobtrusive, to meet stringent acoustic standards, and to provide comfortable conditions. This blend of technical performance and

aesthetic sensitivity transformed the venue into a flexible space capable of supporting a variety of productions.

The Concert Hall and South Block

In 2012, Mueller Associates initiated a multi-phase project to renovate spaces and systems within the 22,000-square-foot South Block area of the Kennedy Center. This extensive project encompassed renovations to the main Concert Hall's primary support spaces, infrastructure provisions for future expansion, and comfort-related enhancements within the Concert Hall itself.

The project required an integrated approach to several engineering challenges. These included developing a comprehensive and improved layout for all existing spaces in the South Block Level A area, designing new practice rooms for the Concert Hall, renovating dressing rooms and restrooms to ensure accessibility, and establishing an appropriate piano-storage area with precisely controlled environmental conditions.

Perhaps the most significant aspect of this project was Mueller's work to improve the Concert Hall's environmental and acoustical conditions by retro-commissioning the existing air-distribution systems, and enhancing automatic temperature control. Mueller's engineers ensured proper humidification, eliminated excessive air movement, and resolved comfort issues for both patrons and performers across four air-handling systems serving the Hall and surrounding spaces.

The project also involved replacing a multizone air-handling unit with a new variable-air-volume system featuring pressure-independent air-terminal units. In addition, Mueller installed new exhaust-air systems, plumbing

fixtures, sprinklers, fire alarm systems, panelboards, lighting, and other elements.

Supporting Artistic Excellence

In 2013, Mueller Associates led the renovation of nine rehearsal rooms, totaling 14,300 square feet. The project emphasized acoustical enhancements, HVAC upgrades, and new lighting and control systems designed for quality, flexibility, and energy efficiency. Although less visible to the public than performance venues, these spaces are vital to the artistic excellence for which the Kennedy Center is renowned, and require the same meticulous attention to acoustics and environmental controls.

The Circles Lounge

In 2014, Mueller Associates helped transform the Circles Lounge (formerly the Russian Lounge). The 3,050-square-foot renovation created an elegant, contemporary setting that befits the Kennedy Center's stunning Mid-Century Modern architecture.

Mueller's engineering supported the creation of this sophisticated space, ensuring that systems remained invisible while showcasing valuable works of art. The project required careful coordination to maintain appropriate environmental conditions for both the comfort of patrons and the preservation of art.

The Terrace Theater

Mueller Associates' relationship with the Kennedy Center reached a new pinnacle in 2018, with a comprehensive modernization of the Terrace Theater. Since opening in 1978 as a gift from the People of Japan, the 487-seat venue

has served as the Kennedy Center’s primary recital hall for chamber music, and its busiest performance space. Despite its beloved status and exceptional acoustics, the Theater had become functionally obsolete, with worn finishes, aging systems, and inadequate accessibility, due to its steeply raked seating.

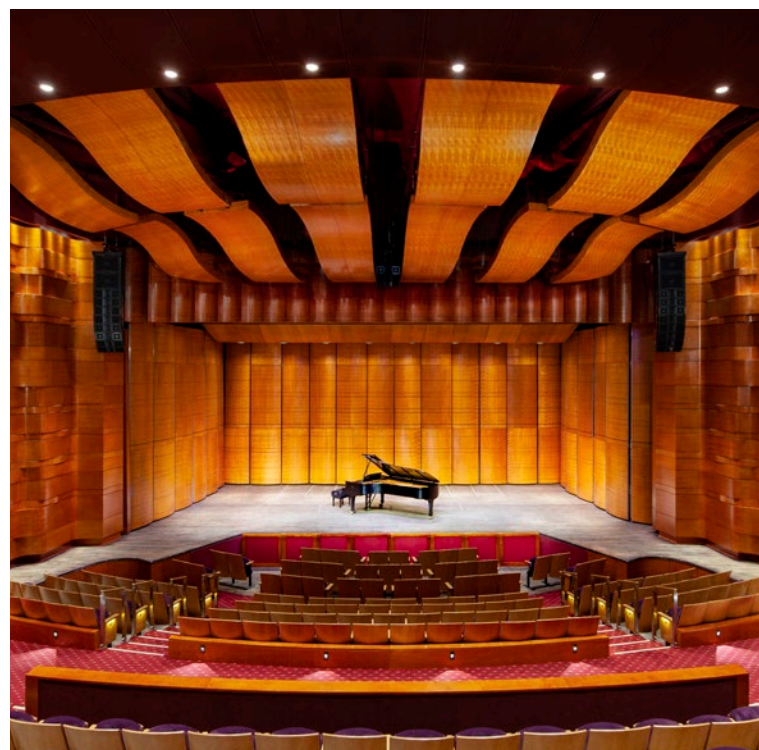
Mueller’s engineering team replaced all of the Theater’s systems, while preserving the Hall’s world-class acoustics. The new mechanical systems featured enhanced variable-airflow controls and advanced sustainability measures, reducing the use of outside air by up to 79%, while maintaining optimal comfort and ventilation. New LED lighting throughout the auditorium and lobby enhanced the visual experience and reduced heat load, enabling a 32% reduction in air volume delivered—crucial for maintaining the quiet environment required for chamber music.

The technical systems developed by Mueller’s engineers supported a comprehensive architectural transformation that optimized sightlines, significantly improved accessibility, and enhanced acoustics through a thoughtfully reshaped ceiling.

The renovated theater reopened to critical acclaim, with *The Washington Post* noting that “there is now a feeling of spaciousness, with gleaming walls, undulating wood (mimicking the sound waves they reflect), wider aisles and curving balconies swelling from the side walls.”

THE 40TH ANNIVERSARY TRANSITION

The year 2006 marked the culmination of Gene Nerf’s strategic vision, representing both Mueller Associates’ 40th



Mueller’s engineering enabled the Terrace Theater’s architectural transformation—improved accessibility, sightlines, and acoustic excellence—all completed while the Kennedy Center remained fully operational, hosting thousands of performances throughout construction.

anniversary, and a carefully planned leadership transition. Having experienced the near-dissolution of the firm during the EA Engineering acquisition, Nerf understood that succession planning was not merely administrative housekeeping, but existential protection. A poorly managed transition could undo decades of relationship building and technical excellence as swiftly as any corporate acquisition.

On January 1, 2006, Bob Marino—who had spent more than two decades with the firm under Gene’s mentorship—was named the firm’s fourth president, as part of a succession strategy years in the making. This appointment represented

both continuity and renewal for the firm, ensuring that the values, relationships, and technical standards that had been so painfully rebuilt after 1992 would endure into the next generation.

“It is fitting that, as we celebrate our 40th anniversary in 2006, we initiate our executive management transition with Bob’s promotion,” said Gene, who continued to serve as chairman of the board. “He’s been a vital part of our organization since 1985. He is trusted by our clients, and respected by our entire team here at Mueller, and he’s an exceptional leader within the engineering profession.”

Marino’s ascension to the presidency demonstrated the success of Gene’s long-term development approach. Marino’s journey with Mueller Associates had begun immediately after he graduated from Penn State in 1985 with a Bachelor of Science in Architectural Engineering, with a focus on Mechanical Engineering. Under Gene’s guidance, Marino enhanced his business acumen by earning an MBA from Loyola University Maryland. His rise through the firm—culminating in his roles as senior vice president and director of operations, before becoming president—mirrored the firm’s own growth and evolution under Gene’s leadership.

“I’ve been fortunate to be a part of Mueller throughout my engineering career,” Marino said at the time of his appointment. “We apply very high standards to everything we do, and that’s been vital to our success and our long-term relationships with clients.” This commitment to excellence would become a hallmark of his leadership style, and a direct reflection of the standards Gene had instilled.

Taking on the presidency brought both opportunities and significant responsibilities. Marino was acutely aware of the legacy he was inheriting. Reflecting upon this pivotal

moment in his career years later, Marino admitted: “It was a little tricky, given the success we had in those years. But there were also some things I thought needed to change. I was conscientious not to try to change the culture, while also moving the firm forward. I felt an obligation, as Gene did, to carry on the name of Richard Mueller and the firm, and the 40-year history we had, which was a big responsibility.”

The transition from engineer to president also required a fundamental shift in perspective—one for which Gene helped him prepare. “I think,” said Marino, “that the hardest thing for an engineer who started in this business as an engineer with the same firm, and with a passion for engineering, is to let that go when you become president. But your responsibilities obviously expand, and you do less engineering and more of the other things.”

This leadership transition reflected the careful continuity planning that characterized Gene’s approach to the firm’s future. Having served as both chairman and president since 1992, Gene remained active in the firm’s leadership, while passing the day-to-day operational responsibilities to Marino.

“I look forward to working with Bob and the board as we continue to grow,” Gene said at the time. “This is an exceptionally talented team of engineers, with a strong commitment to serving our clients well. We clearly understand that our firm’s success has resulted from doing so, and I’m very confident in Mueller’s success in the years ahead under Bob’s leadership.”

Gene’s transition from his role as president, while remaining chairman, underscored another critical lesson from the EA Engineering experience: the importance of retaining institutional knowledge, and giving new leaders the autonomy to



Marino Named President of Mueller

Robert A. Marino, PE, a principal with Mueller Associates who has worked with the firm for more than 20 years, has been named president, effective January 1, 2006. Marino's promotion is part of a long-planned management transition for the firm. He will succeed Eugene F. Nerf, Jr., PE, who will continue to serve as chairman.

Marino joined the firm after graduating from Penn State with a Bachelors degree in Architectural Engineering. He later obtained an MBA from Loyola College. Prior to being named president, he served as senior vice president and director of operations.

Marino has directed many landmark projects for the firm,

success and our long-term relationships with clients."

Nerf had served as both chairman and president of Mueller since 1992. As chairman, he will continue to remain active in the leadership and management of the firm, which was established in 1966. "I look forward to working with Bob and the board as we

The Winter 2006 issue of Momentum, Mueller Associates' company newsletter, announcing Bob Marino's appointment as president. The carefully planned leadership transition—with Gene Nerf remaining as chairman — reflected the firm's hard-won lessons about succession from the EA-Mueller years.

chart their own course. Rather than departing abruptly or micromanaging from the sidelines, Gene remained available as a resource and advisor to Marino and Mueller's board, ensuring the continuity of client relationships and technical expertise, while deliberately creating space for Marino to establish his own priorities, leadership style, and strategic vision. This carefully calibrated approach preserved what the EA period had nearly destroyed—decades of accumulated wisdom about clients, projects, and engineering excellence—while avoiding the stagnation that could result from leaders who refused to let go.

The seamless nature of this transition stood as perhaps the greatest testament to Gene's leadership: he had not only built a successful firm and developed capable successors, but had also created a framework that would allow Mueller

Associates to evolve and thrive beyond his direct involvement, protected by institutional memory, yet empowered to embrace new directions.

A LIFE OF SERVICE: GARY E. JOHNSON

In the same year that the firm celebrated its 40th anniversary, it also marked the retirement of Gary E. Johnson, whose 50-year career helped shape the engineering industry's professional standards, leaving an indelible legacy at Mueller and beyond.

Among the principals who rebuilt Mueller Associates after the EA Engineering interlude, Johnson brought something

that could not be taught in any engineering program: an extraordinary capacity to connect with people. His retirement from Mueller marked the end of an era for the firm—not only because of the technical expertise he contributed during his 51-year career, but also because of the human dimension he brought to every project and every relationship.

Johnson's path to Mueller Associates mirrored, to a remarkable extent, the journeys of Richard Mueller and Gene Nerf before him—a pattern that would become characteristic of the firm's leadership. Like Mueller and Gene, Johnson had graduated from Baltimore Polytechnic Institute (Class of 1955), and immediately joined the engineering firm Henry Adams, where Mueller and Gene had also begun their careers. And, like them, Johnson pursued his mechanical engineering degree at Johns Hopkins University through night school while working full-time: a grueling commitment that demonstrated the same determination and work ethic that had defined Mueller's and Gene's early years.

Even Johnson's service in the Army National Guard echoed his generation's balance of professional ambition and civic duty. This shared foundation—Poly's rigorous technical training, Hopkins' engineering program, and practical experience at Henry Adams—created a common language and mutual understanding within the leadership of Mueller Associates that would prove invaluable during the firm's rebuilding following the EA Engineering period.

"My father was gregarious," Gary E. Johnson, Jr. would recall years later. "He was a mood-changer when he walked into a room. He was a comforting presence." This ability to alter the atmosphere of a space—to make clients, colleagues, and construction teams feel at ease—would become one of Johnson's most valuable contributions to Mueller.

Johnson specialized in healthcare facilities, developing an intimate knowledge of their systems that would prove invaluable to Mueller's institutional practice. For instance, he practically crawled through every inch of the buildings that made up the University of Maryland's medical campus in downtown Baltimore, learning the complexities of these mission-critical facilities from the inside out. His expertise extended to buildings on the Johns Hopkins medical campus in East Baltimore, and he was a member of the original design team for what is now MedStar Harbor Hospital. Perhaps most significantly for Mueller's future, Johnson was part of a team that secured a contract for Wake Forest University Medical Center. This array of experiences enhanced his capability when it came to numerous health-care projects for the firm.

When Gene Nerf decided to reacquire the building systems division from EA Engineering in 1992, Johnson's decision to join him, Richard Mueller, and Alexander Petrlik, proved pivotal. As a principal and vice president of the relaunched Mueller Associates, Johnson brought not only technical expertise, but also his extensive client network and reputation for integrity within the engineering community. His role in reestablishing the firm's credibility cannot be overstated. As Bob Marino later said, "Gary set a very high standard in terms of leadership and establishing trust with our clients. He served our profession with integrity and honor."

Johnson's influence extended far beyond project delivery. He sincerely believed in giving back to the profession, serving as president of the Baltimore chapter of the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE), and as a member of the board of directors for the Engineering Society of Baltimore. He was a charter member of the American Society of Plumbing Engineers (ASPE), and served on the Maryland board of the



The leadership of Mueller Associates in 1992. From left: Richard Mueller, Gary Johnson, Gene Nerf, and Alexander Petrlik: the four principals who rebuilt the firm following the EA Engineering dissolution.

American Council of Engineering Companies (ACEC). His professional accomplishments earned him Fellowships with both ACEC and ASHRAE: recognition that acknowledged not only his technical competence, but also his leadership within the profession. “I firmly believe that you have to give back to the profession,” Johnson once said. “This is especially important in terms of mentoring younger professionals.”

This commitment to mentorship manifested in both formal and informal ways. Johnson contributed his time to the Baltimore Museum of Industry for many years, assisting with engineering presentations for primary school students—planting seeds that might one day grow into engineering careers. At Mueller, he served as a role model, demonstrating

that technical excellence and personal warmth were complementary, rather than mutually exclusive.

By the time Johnson retired from Mueller Associates in 2006, after more than a decade of rebuilding and strengthening the firm, it had regained its footing as a respected leader in institutional engineering.

However, Johnson’s legacy extended far beyond the projects he designed, and the clients he served. He demonstrated that engineering excellence required not just technical mastery, but also human connection—that the best engineers were those who could walk into a mechanical room and understand its systems, then walk



A hallmark of Gary Johnson's leadership was mentoring the engineers who would guide Mueller Associates' future—among them Bob Marino, John Morris, and Ken Rock, shown here in the mid-1990s.

into a boardroom and earn the trust of executives making multimillion-dollar decisions.

Johnson's influence shaped the firm's culture during a critical period of transition, demonstrating that the values Richard Mueller had established could not only survive corporate acquisition and dissolution, but also be strengthened by leaders who recognized that relationships, integrity, and service to the profession mattered as much as technical competence.

In an industry often focused on the tangible—buildings, systems, specifications—Johnson's legacy reminded everyone that it was the intangible qualities that mattered most. His gregarious nature, genuine interest in people, commitment to mentorship, and unwavering integrity set a standard that has continued to influence Mueller Associates.

As the firm navigated the challenges of a new century, the example set by Johnson remained embedded in Mueller's corporate culture: the best engineering serves not just buildings but the people who occupy them, not just clients but communities, not just the present but future generations of engineers who will carry the profession forward.

Gary E. Johnson passed away on May 2, 2020, at age 83, from complications of COVID-19. His passing came 14 years after he retired from Mueller Associates, but his influence on the firm's culture endures to this day.



CHAPTER 6

Pioneering Digital Design

By the late 2000s, Mueller Associates stood at a technological crossroads. The firm Richard Mueller had founded four decades earlier, with a commitment to tackling complex institutional projects, was now evolving beyond traditional engineering into uncharted territory.

The transformation had been building for decades. In the 1980s, Mueller Associates had embraced computer-aided design (CAD) systems, moving from drafting tables to digital workstations: a shift that revolutionized how the firm documented building systems, while leaving the fundamental design process largely unchanged. Engineers still conceived projects much as they had in Richard Mueller's early years, translating ideas into specifications and drawings, albeit with greater precision and efficiency. The computer had proven itself an invaluable tool for execution, yet the creative process remained distinctly human, grounded in experience, calculation, and intuition.

Now, two parallel revolutions were reshaping the engineering profession in ways that promised to transform not just how buildings were documented, but also how they were imagined from the outset.

Two Revolutions Converge

The first was the sustainable design movement. By the late 2000s, sustainability had evolved from environmental advocacy into mainstream building practice, driven by converging forces that made “green” design both imperative and achievable. Rising energy costs, growing awareness of climate change, and mounting evidence of buildings’ environmental impact—they consumed nearly 40% of America’s energy and generated comparable greenhouse gas emissions—had transformed sustainable design from a niche concern into a professional obligation. The U.S. Green Building Council’s (USGBC) Leadership in Energy and Environmental Design (LEED) certification system, introduced in 2000, had gained rapid acceptance across institutional and commercial sectors, providing architects and engineers with standardized metrics with which to measure environmental performance. What began as a voluntary framework had become, by the late 2000s, a requirement for many government projects, and a competitive advantage for private-sector projects seeking recognition.

Yet the movement’s more profound significance lay in its fundamental rethinking of building systems. Sustainable design challenged the conventional separation between architectural form and engineering infrastructure, requiring that MEP systems be conceived as integral to a building’s environmental strategy from the earliest design phases. Passive heating and cooling through building orientation, advanced envelope systems that reduced thermal loads, renewable energy sources that offset grid consumption, sophisticated controls that optimized performance—these were not just additions to conventional engineering. Instead, they required engineers to collaborate more closely with architects, and to master technologies that had scarcely existed when they had completed their formal education.

For engineering firms like Mueller Associates, the sustainable design movement represented both opportunity and obligation: a chance to expand expertise into emerging technologies, and a responsibility to help institutions meet ambitious environmental goals and the precise performance standards that complex buildings demanded.

The second revolution entailed technology—specifically, the emergence of Building Information Modeling (BIM) as a fundamentally new approach to design collaboration. Digital design tools were evolving beyond mere documentation platforms into collaborative modeling environments. These new tools enabled architects and engineers to visualize, test, and coordinate complex building systems in three-dimensional space, before a single component was fabricated. Unlike the CAD systems of the 1980s and 1990s, which essentially digitized traditional drafting, BIM produced intelligent, data-rich models in which every building element—from structural beams, to ductwork, to electrical conduits—served as an object with properties, relationships, and constraints.

When an architect moved a wall, the model automatically updated the affected systems, alerting engineers to conflicts, and enabling real-time coordination that, in previous decades, would have required weeks of manual verification. This shift from two-dimensional drawings to three-dimensional modeling made it possible for design teams to identify and resolve spatial conflicts, optimize system routing, and analyze building performance well before construction began. This, in turn, reduced costly field changes, and improved the precision with which complex systems could be integrated into increasingly sophisticated buildings.

EFFICIENCY:

Energy costs claim hefty share of profits

By Allegra Bennett, contributing writer

As rising energy costs bite deeper into profits, business owners are going through changes. From the gas pump to the mechanical room, owners are scrutinizing every area of consumption to identify ways to save. Getting bad habits under control is resulting not only in savings in operating and maintenance costs but is creating the most important change of all—awareness.

At Wilmot Modular Structures in White Marsh, vice president Kathy Wilmot says thinking about how her company uses energy has made a difference.

"We have a proactive energy program," she says. "We are diligent about turning off lights in unoccupied spaces." Wilmot admits that while the company, which sells and leases portable modular buildings, had an energy policy for some years, that level of consciousness wasn't always practiced.

"We have a preventive maintenance program to change air conditioner filters every month. But (in the past) we never followed our own advice," she acknowledges. "But now we are."

Wilmot's maintenance routine is extended to clients who lease trailers located on dusty construction sites. "We go out and change their filters every month," says Wilmot. Previously uninsulated modular units at the company's site have been upgraded and a supervisor routinely checks the yard and storage locker areas to assure lights and air conditioners have been turned off for the day.

When constructing new facilities,

growing companies are scoring energy conservation points by following guidelines established by the Leadership in Energy and Environmental Design (LEED) Green Building Rating System. This is the nationally accepted benchmark for the design, construction, and operation of high performance green buildings.

Engineers at Mueller Associates Inc. adhere to LEED and use energy modeling in their



INSTALLING ENERGY-EFFICIENT WINDOWS IS ONE WAY TO REDUCE ENERGY COSTS.

job designing mechanical and electrical systems for clients, says company president Bob Marino. "The idea is to fine tune the building envelope." Creating sustainable design in all aspects of the new construction is the goal. Using energy efficient light fixtures, bulbs, ballasts and HVAC systems figure strongly into the energy efficiency planning that

goes into a building and becomes part of its routine tune up.

Marino says business owners in green buildings are increasingly "seeing the benefit for employees and their productivity." Glare free natural light and indoor air quality are important elements. Mueller uses energy modeling in orienting new construction with selection of window sizes, tinting and glazing, insulation, choices in material, and the color of the outside walls. Reduction in water use also is a key inclusion.

Newer green buildings utilize low-flow toilets, sensor-operated lavatories and water-free urinals that don't require flushing. A fluid residing in the trap disposes of the liquid waste. Where double many businesses are having their newly constructed buildings harvest rainwater for irrigation so no new water is used, Marino says.

Both new construction and major renovations trigger compliance with new codes.

When electrical contractors, Key Systems Inc., built its new facilities last summer, management wanted to incorporate as many energy saving features as possible, says company principal and treasurer Chris Eller. The company employs 80 people, of which 68 work in the field and 11 in house. "We use all compact fluorescent fixtures, wall dimmers, programmable thermostats with night and weekend setback features and maintain the thermostat at 78 degrees," she says.

The heat pump is high efficiency and walls and ceilings have High R factor insulation. "We also



BOB MARINO IS PRESIDENT OF MUELLER ASSOCIATES INC., WHERE ENGINEERS USE ENERGY MODELING IN THEIR DESIGNS FOR CLIENTS' MECHANICAL AND ELECTRICAL SYSTEMS. MARINO SAYS BUSINESS OWNERS IN GREEN BUILDINGS ARE INCREASINGLY SEEING THE BENEFIT FOR EMPLOYEES AND THEIR PRODUCTIVITY.

installed tinted windows to help with the sun's rays. All of our HVAC equipment is covered under a scheduled maintenance program allowing for maximum efficiency. All of our office equipment, computers and printers go into energy saving mode when not being used," Eller notes.

The company also has a fleet of 22 vehicles, all of which are on a scheduled maintenance program that includes tire inflations and oil changes, allowing for the maximum gas mileage, she says. "Ten of these vehicles are used by our service technicians so they are required to drive to the office and then two technicians are assigned to each vehicle, thus creating some savings in gas."

While awareness of energy usage is growing and business owners are taking steps toward conservation, there are still some things some owners are not ready to give up. "I still refuse to change the light bulbs in my office lamp," says Wilmot. "I need pretty light. I'll consider changing when they make a pretty energy efficient bulb with a yellow glow," she jokes. •

ENERGY-SAVING TIPS

Observing how your company uses energy is a good way to identify sources that waste energy. The HVAC system and lighting together consume at least 65 percent of all electricity used in an average business facility, according to BGE, and they are the two areas with the greatest opportunities for saving money. Discovering gaps in the performance of the physical plant and addressing wasteful occupant practices can save money.

- Involve employees and supervisors in identifying energy saving opportunities.
- Inspect the building envelope, which is comprised of the roof, walls, windows and doors, all working together in controlling the energy flow between the interior and exterior of the building.
- Check that window and door seals are intact and functioning properly and relet or rehanging doors where necessary.
- Rely more on natural light.
- Turn off lights in seldom-occupied rooms and install motion sensor switches in spaces with intermittent occupancy such as bathrooms.
- Install motion-sensor lavatories when practical.
- Use zoned air conditioning and programmable thermostats.
- Use compact fluorescent bulbs in lamps and light fixtures.
- Set equipment to automatically default to energy-saving mode after long periods of inactivity and at the end of the day.
- Turn off power to computer monitors.
- Change HVAC filters monthly and inspect and clear any clogged condensation lines.
- Perform routine maintenance on fleet vehicles – from oil changes to adjusting tire pressure.
- Hang drapes or shades to block the heat, particularly at single pane or failing windows. •

Bob Marino featured in The Baltimore Sun discussing energy efficiency. The article reflects Mueller Associates' growing reputation as a leader in sustainable design, a practice that would define the firm's work through the late 2000s and beyond.

Mueller Associates' leadership, under President Bob Marino, recognized that the firm's future success would depend not on choosing between these paths, but on mastering both simultaneously. The challenge was to integrate cutting-edge sustainable technologies with advanced digital-modeling capabilities, delivering solutions that were as technically sophisticated as they were environmentally responsible. The firm that had once mastered CAD would need to pioneer again—this time not just adopting new tools, but fundamentally reimagining how engineering expertise could serve an increasingly complex built environment.

The convergence of these two revolutions—sustainable design and digital modeling—would soon be tested at one of America's most culturally significant sites, in a project demanding both environmental innovation and profound respect for architectural heritage. Mueller Associates' first geothermal engineering design would take place not on a conventional campus or office building, but at Thomas Jefferson's Monticello, where engineering excellence would also need to honor the legacy of America's most visionary architect-president.



GEOTHERMAL ON A MOUNTAIN: THE THOMAS JEFFERSON VISITOR CENTER

High atop a Virginia mountain in Charlottesville stands one of America's most treasured architectural landmarks: Monticello, the home of Thomas Jefferson, the nation's third president, primary author of the Declaration of Independence, and a visionary architect in his own right. Jefferson designed this Neoclassical masterpiece himself, drawing inspiration from the works of 16th-century Italian architect Andrea Palladio, and Jefferson's own travels throughout Europe. The resulting structure became one of America's most influential architectural achievements, introducing Neoclassical design principles that would shape the nation's civic architecture for generations to come.

Construction of Monticello spanned four decades, from 1769 to the early 1800s. The mansion was built primarily by enslaved craftsmen and laborers: carpenters, stonemasons, bricklayers, and other artisans whose names history has largely forgotten, but whose exceptional work helped create this enduring symbol of American ideals. The property encompasses Jefferson's carefully planned mountaintop estate and his experimental gardens. It also includes the remnants of Mulberry Row, where hundreds of enslaved workers lived and labored, reflecting the complex story of early American democracy, built upon the contradiction of human bondage.

Jefferson's Architectural Legacy

When the Thomas Jefferson Foundation formally acquired Monticello in 1923, the property consisted of 650 acres: a significant reduction from the 5,000 acres Jefferson owned at the time of his death in 1826. The Foundation soon embarked upon an ambitious program of architectural restoration and scholarly research. Simultaneously, the Foundation developed Monticello's role as an educational institution and center for democratic values.

The culmination of this extraordinary stewardship came in December 1987, when the United Nations Educational, Scientific and Cultural Organization (UNESCO) World Heritage Committee designated both Monticello and the University of Virginia (which Jefferson had also designed) as World Heritage Sites, making Monticello the only private presidential home in the United States to be designated a UNESCO World Heritage Site.

However, by the early 2000s, this very success had led to new challenges. The Foundation recognized that Monticello's original public facilities, built in the 1950s, were inadequate to serve the site's 450,000 annual visitors, or to properly contextualize Jefferson's legacy for contemporary audiences. As a result, the Foundation sought to develop a new education center that would have a minimal impact on the historic site, while still providing an inspiring "gateway" experience for visitors as they arrived to tour one of the country's most famous residences. The challenges were unique: creating a modern educational facility that could accommodate substantial visitor flows, incorporate advanced interpretive technology, and meet 21st-century accessibility standards—all while respecting the integrity of Jefferson's meticulously designed landscape, and honoring the site's profound historical significance.

A 21st-Century Challenge

This complex undertaking would require an engineering team capable of matching Jefferson's innovative spirit with progressive, sustainable design solutions. As Mueller Associates expanded its sustainable design portfolio in the late 2000s, the **Thomas Jefferson Visitor Center** project presented an opportunity that aligned with the firm's commitment to pioneer sustainable solutions and advanced technological capabilities.

For Mueller, this project proved transformational. "The Monticello Visitor Center was an instrumental project," Todd Garing later recalled. The new Visitor Center presented multifaceted programming challenges, making it an ideal testing ground for innovative engineering solutions.

The 42,000-square-foot complex would comprise five pavilions constructed on a sloping hillside site, surrounding a central courtyard. The three-level structures would house four major exhibitions, a theater, gift shop, café, classrooms, and the Griffin Discovery Room. Each space required distinct environmental conditions—from the precise temperature and humidity controls needed for museum exhibitions, to comfort-based considerations for a performance venue, to the operational requirements for food-service areas.

Engineering Meets Historical Preservation

This project challenged conventional approaches to the design of both geothermal and museum systems. Geothermal technology excels at providing energy efficiency, by leveraging Earth's stable subsurface temperatures to reduce heating and cooling costs; however, these systems typically operate within temperature ranges suitable for offices, schools, and residential buildings. Museums

require more than efficiency; they require unwavering precision across all operating conditions, with backup systems and built-in redundancies, to ensure that no equipment failure compromises irreplaceable collections.

As Garing explained, “People may think of geothermal as merely a field of boreholes, and then inside, you have equipment similar to what you’d find in a residence.” The Monticello project, however, demanded a more sophisticated approach. “At Monticello, that really wasn’t an option,” he continued. “Inside the building, the systems required the more demanding environmental conditions of a museum. So you have this different [geothermal] system—and at the time, the two weren’t typically married together.”

The challenge was integration: how to harness geothermal technology’s environmental and efficiency advantages while layering on the precision controls, redundancy, and fail safes that museum curators and conservators rightfully demanded. Although traditional geothermal heat-pump systems were not frequently used in museum settings, Mueller’s solution combined two established technologies to maximize the benefits of both.

The geothermal field would provide an energy-efficient foundation, while sophisticated air-handling systems with multiple control stages would deliver museum-grade environmental stability. The results demonstrated the energy efficiency and environmental benefits of geothermal technology, while maintaining the precise control required to sustain museum-quality environmental conditions.

This integration underscored Mueller Associates’ innovative engineering- and problem-solving approach, and it would help to open new possibilities for sustainable design at other cultural institutions.

Obstacles Become Advantages

The historic mountaintop location presented immediate technical challenges that initially seemed formidable. The first major obstacle was the site’s geology. “We were drilling through 500 feet of granite,” said Garing. The drilling process required specialized equipment and techniques to penetrate the dense rock formations, making it both expensive and time-consuming. The installation of 72 boreholes through the granite took approximately six weeks—a challenging process that tested both equipment and patience.

Yet what appeared to be the project’s greatest challenge ultimately became its most significant technical advantage. “The positive side of drilling through 500 feet of granite is that you don’t have to put grout all the way down through the boreholes,” Garing explained. Traditional geothermal installations typically require grout backfill, which can limit heat-transfer efficiency. However, the Monticello site’s unusual geology allowed for a superior solution that would revolutionize the system’s performance.

The second challenge involved water management. As Garing noted, “The water table was relatively high, so when they were drilling these boreholes, significant groundwater evacuated through holes at the surface. They had to make sure that they were treating that respectfully with their neighbors, and that erosion wasn’t an issue.” This required careful coordination with environmental specialists, and the implementation of water treatment protocols to protect the surrounding landscape.

Again, Mueller’s team discovered that an apparent obstacle offered unexpected benefits. The abundant groundwater flowing through the granite’s aquifers created ideal conditions for heat transfer. The continuous underground flow

of water naturally dissipated thermal buildup, preventing the ground-temperature saturation that typically occurs when heat is repeatedly added to, or extracted from, the land itself. This natural heat-distribution system made the geothermal installation remarkably efficient.

The cultural sensitivity required for working at a UNESCO World Heritage site presented the third major challenge. Every aspect of engineering had to respect the historical and cultural significance of Jefferson's home, while meeting contemporary performance standards. The incorporation of state-of-the-art, environmentally friendly design concepts created additional complexity for the architectural and engineering teams. Mueller's engineers designed creative solutions that would enhance, rather than detract from, the site's historic character, ensuring that the design supported the Foundation's mission of education and preservation.

The final system consisted of nine geothermal heat-recovery chillers, organized into carefully designed piping circuits, with variable-flow pumps and high-density polyethylene piping. This created a closed-loop system that served as the backbone of the facility's environmental control strategy. The design incorporated energy-efficient heat pumps, with multiple control stages, to address varying load levels across the diverse spaces.

Sustainable Systems Integration

Mueller's comprehensive engineering approach extended far beyond an innovative geothermal foundation. The team also implemented a high-performance variable-air-volume (VAV) reheat system that provided precise climate control across the facility's diverse spaces. This system operated in concert with demand-controlled ventilation technology, using carbon dioxide sensors to automatically adjust

fresh-air intake based on actual occupancy levels, thereby optimizing both energy efficiency and indoor air quality.

The mechanical systems incorporated exhaust-air energy recovery, capturing waste heat from outgoing air to pre-condition fresh air. Combined with the geothermal infrastructure, this provided multiple layers of efficiency, contributing to the project's anticipated 32% energy savings, in relation to the applicable ASHRAE Standard 90.1 energy baseline. Water conservation measures were equally comprehensive, with the implementation of waterless urinals, dual-flush toilets, and low-flow sinks, resulting in an anticipated 43% reduction in water use, relative to standard fixtures. These energy- and water-saving strategies helped the new Visitor Center achieve LEED Gold certification, demonstrating the project's progressive commitment to sustainability.

The sophisticated systems integration presented unique engineering challenges. "The Visitor Center features very high-end finishes, and it was a challenge to incorporate the systems, yet conceal all of the components," said Garing. "We needed to heat, cool, light, and add sprinklers to the space in an unobtrusive way that was also effective and efficient. This is a building that required close integration of the architecture and the engineering design, and an appreciation for the architects' vision."

The electrical systems reflected equally sophisticated environmental consciousness. Mueller's engineers designed an integrated lighting-control system that can be centrally programmed, or controlled at individual locations throughout the facility. The system features central lighting controls with occupancy sensors, and energy-efficient linear and compact fluorescent lamps with low mercury content and UV filters. Advanced controls manage dimming, audiovisual systems, motorized shades, and exterior lighting through



The Thomas Jefferson Visitor Center and Smith Education Center at Monticello, where Mueller Associates engineered the geothermal system that earned the facility LEED Gold certification.

a common interface, representing cutting-edge building automation technology for museum facilities in the early 2000s.

Exterior lighting followed “Dark Sky” principles: a philosophy that minimizes light pollution and preserves the natural nighttime environment, while providing necessary security and wayfinding illumination. The design introduced minimal site lighting to reduce both light pollution and energy use. This approach was particularly important at Monticello, where preserving the historic character of Jefferson’s mountaintop setting was paramount.

The geothermal system also provided crucial aesthetic benefits for the historic site. “There is no exterior [visible] equipment, and that is an important consideration for a historic site, in terms of both noise and sightlines,” Garing

explained. The absence of cooling towers or condensers preserved the visual integrity of Jefferson’s carefully designed landscape: a consideration that proved essential to maintaining its UNESCO World Heritage Site designation.

Concealing Complexity

Collaborating closely with the project’s architects at Ayers Saint Gross, Mueller’s engineers integrated various sustainable features throughout the Visitor Center. Optimization of the building envelope included high-performance glass with external shading, advanced wall insulation, and a structural insulated-panel roof system. The Visitor Center features three green roofs, and an onsite wastewater treatment plant that supplies a drip-irrigation field. The closed-loop geothermal system required minimal additional water, resulting in annual water savings of approximately 850,000

gallons, compared to conventional water-cooled chillers. The Visitor Center has become a model for sustainable design at historic sites, demonstrating that innovative engineering can enhance, rather than detract from, America's cultural treasures.

For Mueller Associates, the Monticello Visitor Center project exemplified a perfect alignment of technical expertise, cultural significance, and environmental stewardship: values that would have resonated with Jefferson himself, who had been known for his interest in innovative architecture and engineering. By successfully meeting this challenge, Mueller Associates had not only completed its first geothermal project, but had also demonstrated how modern engineering could honor the past while building toward a more sustainable future.

FROM MONTICELLO TO THE MAINSTREAM

The success of Monticello's Visitor Center opened doors to numerous other sustainable-design projects, reflecting the growing expertise of Mueller Associates across diverse building types. At the same time, the firm's leadership recognized that environmental innovation alone would not be sufficient. By 2010, Mueller Associates had begun to position itself at the forefront of another revolution—one that would fundamentally transform how buildings were designed and engineered.

This forward-thinking philosophy was exemplified by Mueller's adoption of Autodesk Revit® MEP, an advanced software platform for building design, which transformed its approach to project delivery. The **University of Delaware Admissions Center**, a 30,000-square-foot facility on the

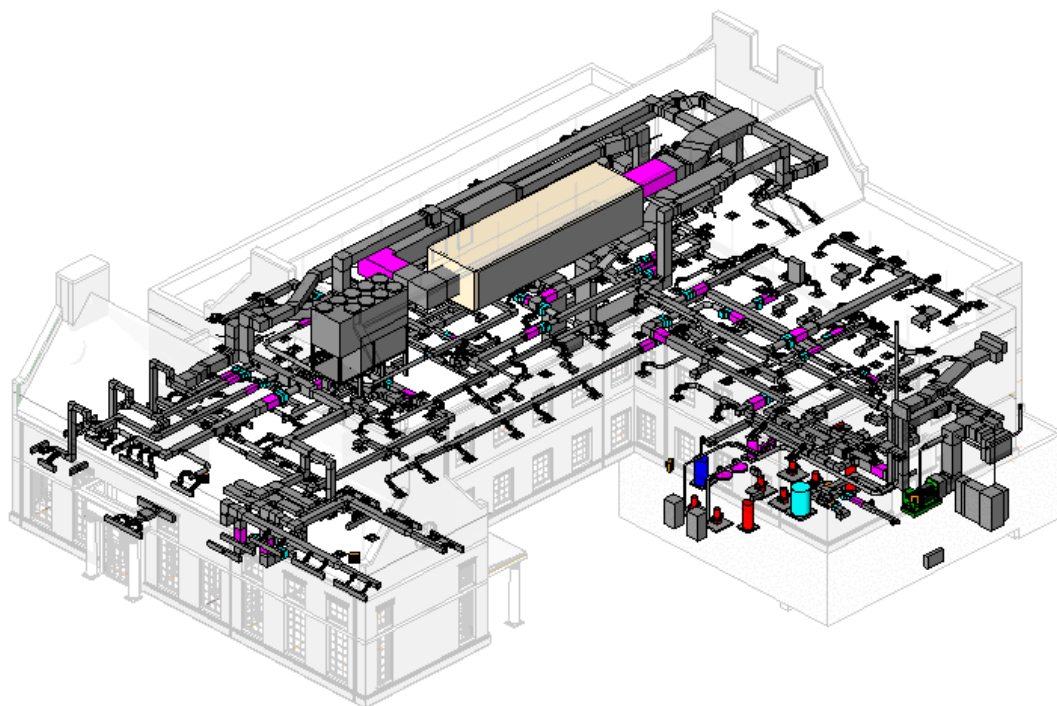
university's Newark campus, became Mueller Associates' inaugural project with this revolutionary platform, marking a pivotal turn in the firm's technological evolution.

As one of the first higher-education projects in the region to be designed using Revit, the Admissions Center positioned Mueller at the forefront of the BIM revolution that would reshape the engineering profession. The decision to adopt this technology represented more than just the use of new tools—it was a strategic commitment to transforming how buildings are designed and engineered.

Programmed to support the emerging concept of BIM, Revit enabled architects and engineers to coordinate design work in real time, enhancing workflow, communication, and the level of detail in construction documents. Working closely with Ayers Saint Gross, architect of the Admissions Center project, the Mueller team discovered that the software provided unprecedented visibility into how design changes in one discipline affected others.

Mueller Associates' commitment to Revit soon extended far beyond merely purchasing software licenses. The firm invested in comprehensive training for all of its engineering staff, recognizing that true technological transformation required human expertise to match digital capabilities. This early adoption enabled Mueller's engineers to collaborate seamlessly with architecture firms that were also embracing technological innovation. Within less than a year, Mueller Associates had progressed beyond the experimental phase, and had established Revit as the firm's standard platform for project delivery. "It's the future," Garing said back then.

This prediction proved prescient, as BIM adoption accelerated across Mueller and the broader industry in subsequent years. By 2012, when Mueller's entire engineering team had



Mueller Associates' first Revit BIM model, created for the University of Delaware Admissions Center. The project marked the firm's transition from traditional CAD drafting to fully integrated digital design, a shift as significant as the move from hand-drafting three decades earlier.

achieved proficiency in Revit, the firm had positioned itself at a unique intersection of technological advancement and environmental innovation. The integration of digital design tools with sustainable-engineering solutions created new possibilities for optimizing building performance, while also streamlining the design process.

The three-dimensional modeling capabilities of Revit proved particularly valuable for sustainable-design projects—especially renovation work in historic buildings, where space constraints often necessitated creative solutions in order to incorporate modern, efficient systems. The software's ability to model complex geometries and system interactions enabled Mueller's engineers to, for example, optimize geothermal installations, plan intricate ductwork routing, and coordinate renewable energy systems.

This foundation of technical expertise and sustainable innovation would soon be tested by some of the firm's most ambitious projects to date: undertakings that would require Mueller Associates to navigate the intricate challenges of integrating cutting-edge environmental technology with historically significant architecture. The next phase of the firm's evolution would require not only technical proficiency, but also mastery of complexity itself, as it undertook projects in which every decision balanced performance, preservation, and pioneering sustainability goals.



CHAPTER 7

Four Presidents, One Enduring Vision

In 2006, Mueller Associates marked its 40th anniversary. It was an important milestone, inviting reflection upon the firm's evolution and culture, and the continuity of its leadership. What had begun as a modest practice in a Baltimore suburb had grown into a highly regarded engineering firm specializing in institutional buildings, museums, performing arts centers, laboratories, and academic facilities. Rather than marking 40 years with a dramatic celebration, the firm approached the occasion in the same manner that had characterized its work from the beginning: steady leadership, appreciation for its people, and a renewed commitment to the principles that had sustained it.

Over the firm's 40-year history, the leadership of Richard Mueller, Andrew Parker, Gene Nerf, and Bob Marino had shaped its direction and culture. To commemorate the milestone, the firm produced a special marketing piece honoring its four presidents, and their collective influence on the company's evolution. Although each president governed during a different era, each marked by distinct technical and economic conditions, their reflections, recorded and published for the anniversary celebration, revealed consistent themes: disciplined engineering practices, respect for clients, investment in staff, and meticulous attention to detail.



Four PRESIDENTS

Richard Mueller, P.E. **President, 1966-1984**

Mueller Associates got its start in June 1966, and was originally known as Engineering Services Company, or ENSERCO. The company was based in Glen Burnie, Maryland, and was a very small operation. Within two years we had a staff of eight, I became president, and we changed our name to Mueller.

I had always wanted to be at the helm of my own firm, and I envisioned growth—but I didn't envision the success we experienced. One of the reasons for our success over the years is that Mueller has always had a great nucleus of exceptional people. There has always been a lot of talent at Mueller, along with integrity and a love of the profession.

A major turning point was our decision in 1973 to expand the ownership of the firm. I realized that by bringing in partners—including Jim Wetzel as chief electrical engineer and Andrew Parker, a former classmate of mine—we could broaden our opportunities. I knew Andy could open new doors with his expertise in emerging technologies. And he did—he helped bring us national exposure and enhanced our building systems work.

Gene Nerf was also on board from the beginning. It was the professionalism of engineers like Gene that kept clients coming back. Mueller has clients today that he's worked with throughout all 40 years.

Since my retirement as chairman in 1994, I've observed with pride the continuity of leadership and Mueller's continued success.



Andrew Parker, P.E. **President, 1984-1991**

When I joined the firm in 1973, I had known Richard Mueller for years—we were classmates at Johns Hopkins University.

Beginning in 1974, we began to support the EPA with its efforts to explore alternative fuels. The environmental movement was really starting to gain momentum. So much of our work at that time was not typical to engineering firms like ours. It was pioneering—we were on the leading edge of our profession. We supported the EPA, ERDA, and the U.S. Department of Energy.

Many innovations during the 1970s were in solar technology. We designed the first solar projects in Washington, D.C. and Baltimore, and completed a solar energy system for the White House and one of the Congressional buildings.

I had a background in aerospace engineering, and was interested in breakthrough technologies that were just about to transition to everyday use. The culture at Mueller has always embraced that kind of innovative approach. It's a philosophy that asks, how can we think ahead of the curve? How will that benefit our clients?

Innovation isn't the only thing that sets Mueller apart. It's the business culture as well. The level of trust and respect within the firm is very high. The engineers are all highly qualified and well suited to this work. There is never a question that Mueller will deliver upon its promises to clients.

A LEADERSHIP RETROSPECTIVE

In recounting the firm's earliest years, founder Richard Mueller recalled a small Glen Burnie office staffed by just a handful of engineers, along with an early reliance upon hard work, technical skill, and long hours to meet demanding project deadlines. After purchasing ENSERCO, he emphasized the importance of expanding ownership—which he did, for example, in 1973, by bringing in Andrew Parker. That decision broadened the firm's technical capabilities, and laid the groundwork for future growth. Mueller also recalled the significant contributions of early staff members—particularly Gene Nerf, whose professionalism, consistency, and technical prowess established credibility.

Andrew Parker, who served as the company's second president, from 1984 to 1991, reflected upon the firm's involve-

ment in some of the nation's earliest solar and environmental design projects—including, most notably, the White House. He remarked that much of the firm's engineering work in the 1970s was atypical for firms of similar size. The establishment of Mueller's Technology Application Division and Energy and Environmental Systems Department, for example, positioned the company at the forefront of energy conservation and renewable energy systems, at a pivotal time in American environmental history.

Parker described the firm as one in which trust and respect were integral to its culture, enabling staff to pursue innovative approaches to complex challenges. He also observed that the company had cultivated a reputation for delivering on its promises.



Eugene Nerf, P.E.
Chairman of the Board
President, 1991-2005

When we started out, we were very small, and it was simply a matter of survival. Our first big project came in 1968—the expansion of North Arundel Hospital. Richard Mueller's expertise made it all work. I learned something from him on every job. He was a terrific mentor, with high integrity and strong convictions.

Another early milestone project was the west front of the National Cathedral in Washington, D.C. It was a challenge to design custom-fit HVAC systems that could be installed within the stone and marble structure. We worked on it for more than ten years. It was a unique experience.

When Andy Parker came on board, we began to specialize in energy conservation and new technologies. Then, in the mid-1970s, we landed a couple of

important cultural projects—the Baltimore Museum of Art and the Lyric Opera House, which led to work with the Smithsonian. These experiences were important building blocks to becoming the firm we are today.

The construction of our own building in Baltimore in 1981 was another milestone. We were stable and growing quickly. From the beginning, Richard Mueller established a culture that was quality-driven. We never made assumptions on projects; we never guessed. The details were important. His values and professionalism became inherent qualities here. I see that in Bob Marino today. Bob is an exceptional leader—people-oriented, honest, and an excellent engineer.

We've worked hard to set ourselves apart. We've tried to be selective about our staff, and our work. We believe that specialization can be a good thing—we focus on our strengths. The future holds a lot of promise. This firm has been a big part of my life and I am very proud to be a part of it.



Robert Marino, P.E.
President, 2006-Today

After graduating from Penn State, I was looking for a firm that could provide good training and feed my desire to problem-solve on unique and interesting projects. That firm was Mueller. I started work in the summer of 1985.

My first project was the National Museum for Women in the Arts, a renovation of the old Masonic Temple building in Washington, D.C. The challenge of designing a museum HVAC system within a historic building ignited my passion for this business. I was fortunate to work with Gene Nerf. He was the ideal professional mentor. The start of that relationship and friendship was a milestone in my career.

As a young engineer, I was also intrigued by the management of the business. I wanted to provide input to strategic decisions and enjoyed the relationships

with architects and building owners. This encouraged me to pursue my postgraduate degree in business administration. The leadership of the firm has always provided opportunities for professional advancement.

There are many things that set Mueller apart. We are focused, and we have a talented and creative staff. We are fortunate to have sophisticated clients who expect high-quality engineering solutions. Our client relationships are extremely meaningful to us. They consistently drive us to be at our best.

We are very optimistic about the future of Mueller. Thanks to Gene Nerf, we have accomplished a significant transition of ownership that will provide continuity of the firm without disruption. We have built additional office space to allow for growth. We have reorganized our project teams to be more responsive to clients and have given senior managers more line responsibility. We are well prepared to succeed over the next 40 years.

Gene Nerf, who served as the firm's third president, from 1992 to 2006, offered a broader historical perspective, drawing upon nearly 50 years of personal experience. Having joined in the 1960s, he lived through the company's early struggles, major institutional commissions, and eventual specialization in complex building types. He noted that Richard Mueller had established a quality-driven culture, shaped by a refusal to make assumptions or accept incomplete information. Gene believed that this culture persisted across generations, and continued to influence the firm's work during his leadership.

Bob Marino, who became the firm's fourth president in 2006, described his early project experiences, including work on the National Museum of Women in the Arts with Gene. This

experience introduced Marino to the complexities of HVAC design in museum environments, and demonstrated the importance of collaboration and relationship-building with architects and curators. Marino credited Gene with providing critical mentorship during his early years. His reflections underscored the importance of maintaining strong client relationships, which he viewed as central to the firm's long-term stability.

A Culture Guided by Four Commitments

As part of its 40th anniversary commemoration, Mueller Associates articulated four commitments summarizing the principles that had guided the firm since its founding. These pledges were: one, attracting and mentoring skilled

engineers; two, selecting projects that aligned with the firm's specialized expertise; three, providing leadership within the engineering profession; and four, maintaining client commitments through responsive service and thoughtful engineering solutions.

Rather than introducing new objectives, these renewed vows codified longstanding practices that had shaped the firm's identity from the beginning. They provided a coherent framework for future growth, ensuring that the values embedded by the company's first four presidents would remain central to its work. Today, 20 years after they had first been articulated, these pledges remain central to the identity of Mueller Associates, shaping its approach to mentoring engineers, selecting specialized projects, contributing to the engineering profession, and sustaining strong client relationships.

In the midst of this celebration, it became clear that, although the company bears Richard Mueller's name, its history cannot be understood without acknowledging Gene Nerf's central role. His tenure with the firm spanned its entire existence, and his influence shaped every aspect of its development—from early project delivery and technical standards, to longstanding client relationships and the mentorship of future leaders. While Richard Mueller established the firm and set its foundational values, Gene sustained those principles through decades of growth and change.

His leadership proved particularly pivotal following EA Engineering's acquisition of the firm in 1988. When Gene decided to reestablish Mueller Associates as an independent practice in 1992, he persuaded Richard Mueller to join him in repurchasing the company. Without Gene's determination to preserve the firm's identity and culture, Mueller Associates would not exist today. His presence

provided continuity across multiple generations of staff and leadership, and the standards he instilled continue to inform the firm's practices. In many ways, the stability, reputation, and culture that define Mueller Associates are inseparable from Gene's five decades of service.

THE CAREER OF GENE NERF: A 50-YEAR LEGACY

Besides Richard Mueller, no other individual has shaped the firm's success as much as Gene Nerf.

Gene's association with the firm began in 1963, when he joined N.P. Lloyd & Associates as a 19-year-old draftsman. Following Lloyd's sudden passing in 1966, and the subsequent establishment of ENSERCO, Gene became—and remained—an important pillar in establishing the foundation of Richard Mueller's acquisition.

Gene's early career combined rigorous technical training with hands-on practical experience. He completed the Baltimore Polytechnic Institute's "A Course"—a thorough engineering preparation program—and attended Johns Hopkins University while working full-time. His combination of formal education and practical drafting experience made him an essential contributor during ENSERCO's earliest years.

After Richard Mueller acquired ENSERCO, Gene's responsibilities expanded rapidly. By the mid-1970s, he had become a registered professional engineer and the firm's second-most-important technical leader, alongside its eponymous founder.



A young Gene Nerf (left), and on site at the Winterthur Museum (right) after becoming Mueller Associates' third president. The span between the two photographs measure not just decades, but the full arc of a career built at a single firm.

Early Projects and Technical Foundation

Gene's influence is evident in many of the earliest and most significant projects undertaken by Mueller Associates. During the 1970s, he provided design leadership on the Washington National Cathedral: a complex assignment that required integrating modern HVAC systems into a historic Gothic Revival structure, without altering its architectural character. His work on this project helped establish Mueller as a trusted partner for cultural institutions.

Gene contributed to similarly complex commissions throughout the 1980s and 1990s, including major expansions and renovations at the Baltimore Museum of Art, the Walters

Art Museum, and numerous facilities at the Smithsonian Institution. Gene also played a central role in the firm's decades-long partnership with Northrop Grumman, contributing to hundreds of commissions that encompassed research facilities, infrastructure upgrades, and capital improvements.

From 1992 to 2006, during Gene's tenure as president, Mueller Associates enjoyed organizational stability, technical refinement, and strategic reorientation. His presidency began at a decisive moment. In 1988, the firm had been acquired by EA Engineering, which altered the ownership structure and introduced new administrative requirements. When Mueller Associates regained its independence in

1992, the firm faced the challenge of reestablishing its identity, reorganizing its operations, and restoring the sense of continuity that had characterized its earlier decades. Gene became president against this backdrop, and his leadership was central to guiding the firm through the transition.

Presidential Leadership

One of Gene's priorities as president was to reaffirm the firm's focus on institutional projects. Throughout the 1970s and 1980s, Mueller Associates had built a strong reputation for work in museums, historic buildings, performing arts facilities, and higher-education environments. Under Gene's leadership, the firm refocused on these markets, strengthening relationships established decades earlier with institutions such as the Smithsonian, Georgetown University, the Baltimore Museum of Art, and Northrop Grumman. Mueller Associates also cultivated new partnerships at Wake Forest University, the Walters Art Museum, and Winterthur Museum, among others, and with architects and others who valued disciplined documentation and consistent project delivery.

Gene's presidency also marked a period of formalized internal coordination. He emphasized clarity, accuracy, and completeness in contract documents—not as procedural requirements, but as the foundation of a responsible engineering practice. Under his direction, project teams refined internal review processes, enhanced interdisciplinary collaboration, and improved constructability throughout the bidding and construction phases.

As Mueller Associates grew, Gene also recognized the importance of developing its next generation of leaders. Throughout the 1990s and early 2000s, he elevated senior engineers into positions of greater responsibility. Staff

such as Bob Marino, Ken Rock, John Morris, and others, were named associates, vice presidents, or senior leaders during this period. These promotions were not symbolic; each reflected Gene's belief in continuity, professional development, and maintaining strong technical leadership across all disciplines. Many of the individuals elevated during Gene's presidency would go on to guide the firm's operations well into the 2010s and 2020s, underscoring the long-term impact of his leadership decisions.

While serving as president, Gene also continued to oversee major projects directly. His involvement ranged from complex museum renovations and academic-science facilities, to large-scale infrastructure improvements.

Gene's continued participation in project work also reflected his broader view of leadership. He believed that leadership required active engagement in everyday design challenges, not merely administrative oversight. Even while managing firm-wide responsibilities, he maintained a regular presence in project discussions, drawing reviews, and client meetings. Staff frequently recalled that his approach provided both technical guidance and a clear example of the standards expected across the organization.

As Mueller's president, Gene also supported the expansion of project delivery and office infrastructure. During his tenure, the firm completed its 500th project for Northrop Grumman, and began preparing for future growth through selective hiring and strategic workload management. The firm also reinforced its reputation across the greater Mid-Atlantic region, strengthening its presence within the academic and cultural markets.

During Gene's 14-year presidency, Mueller Associates enjoyed consolidation and continuity, which was much need-



Gene Nerf alongside Richard Mueller, circa early 1980s; at his retirement party with his successor, Bob Marino, in 2013; and a decade later, with Bob Marino and Todd Garing at the company's holiday party in 2023. Few figures in the firm's history connect its founder to its current leadership the way Gene has done.

ed after the EA Engineering acquisition. His presidency bridged the firm's early generations and its later era, ensuring that the principles established by Richard Mueller remained central to its work well into the 21st century.

Recognition and Lasting Impact

In 2013, Mueller Associates celebrated Gene's retirement, following 50 years of professional practice. Colleagues described Gene as a mentor whose guidance had shaped their professional development. His *Golden Anniversary* book documented career milestones, and included recollections

that emphasized his work ethic, technical insight, and influence on the firm's culture.

To this day, Gene's legacy remains central to the identity of Mueller Associates. His technical approach—characterized by thorough reviews, careful coordination, and reliable documentation—continues to inform the firm's internal standards. Moreover, his mentorship has shaped multiple generations of engineers, many of whom now hold senior leadership roles and preserve the same disciplined practices and client-centered values he exemplified throughout his 50-year career.



Bob Marino, early in his career at Mueller; at work onsite at the National Academy of Sciences; and with Gene Nerf, the president who preceded him. These images tell the story of a career built upon mentorship, hands-on engineering, and loyalty.

BOB MARINO: LEADERSHIP FOR A NEW GENERATION

When Bob Marino became the fourth president of Mueller Associates in 2006, he was the first leader whose entire professional career had been shaped by the culture and by technical standards established by Richard Mueller and Andrew Parker and sustained by Gene Nerf. Marino joined the firm in 1985, right out of Penn State University's architectural engineering program: a curriculum that appealed to him as a synthesis of architecture, mechanical systems, and the applied sciences.

As Marino later reflected, he had long been drawn to architecture, art, and drawing. Architectural engineering provided a practical outlet for these interests. His introduction to Mueller Associates came through an interview held in a modest hotel room near campus, where Richard Mueller and Gene Nerf had traveled to speak with graduating students. The conversation left a lasting impression. Although he had several employment options, Marino recalled that the combined experience, sincerity, and enthusiasm of the two senior engineers "just really resonated," giving him a strong sense that Mueller Associates was the place where he wanted to build his career.

Upon joining the firm, Marino entered a demanding work environment. The firm was bustling, and Marino was quickly assigned to a significant cultural commission: the conversion of a former Masonic Temple in Washington, D.C., into the National Museum of Women in the Arts (NMWA). This assignment became a formative experience in his career.

Marino's first museum project also ignited his longstanding interest in cultural facilities. NMWA introduced him to the unique demands of museum HVAC design, including precise temperature and humidity controls, sensitive acoustical considerations, and careful integration of duct and piping systems within historic buildings. Over time,

he became one of the firm's leading specialists in museum and cultural work, contributing to a portfolio that included the Baltimore Museum of Art, the Walters Art Museum, the Lyric Opera House, the Maryland Historical Society, the Enoch Pratt Free Library, Winterthur Museum, Hagley Museum and Library, and large-scale Smithsonian projects, such as revitalization of the National Air and Space Museum. As Marino advanced from engineer to project manager, then from director of operations to principal, he consistently emphasized that museum, and all institutional work, required both technical precision and a sensitivity to architectural intent. He further noted that success depended upon "keeping systems as invisible as possible, while ensuring the strictest environmental requirements."

Marino also gained early exposure to large-scale institutional buildings through projects such as the General Accounting Office (GAO) headquarters in Washington, D.C.: a two-million-square-foot facility whose mechanical complexity served as an instructive counterpoint to the firm's more specialized cultural commissions. His work at Johns Hopkins University—notably on the Space Telescope Science Institute project, and renovations of Maryland and Krieger Halls—as well as work at Wake Forest University's Gray Building—further broadened his understanding of laboratories, high-intensity air systems, and the challenges of facility modernization. This combination of project types—museums, historic structures, laboratories, and large federal facilities—prepared him to lead the firm's technical practice, while shaping the project portfolio that would define his presidency.

Stewardship and Strategic Growth

When Marino became president of Mueller Associates in 2006, he inherited an organization with a well-established

reputation, albeit operating within a rapidly changing environment. The early 2000s saw the introduction of BIM platforms, the increased use of computer-based tools, and heightened expectations for digital coordination. Architectural clients had adopted Revit and other new design technologies, and encouraged Mueller Associates to do the same. Marino recognized that, although the firm's technical standards were strong, adapting to new workflows and digital platforms was essential to maintain competitiveness and strengthen architectural partnerships. He guided Mueller Associates through this transition carefully, while preserving the firm's traditional emphasis on quality, accuracy, and visual clarity in construction documentation.

Marino also placed renewed emphasis on staff development and internal succession planning. He believed that one of the firm's distinguishing strengths was its ability to attract and retain engineers who made a long-term commitment to the practice. Today, nearly all of the firm's leaders began their careers at Mueller, shaped by its internal mentorship culture. He often emphasized that the firm's success depended not only upon technical competence, but also upon the ability to communicate effectively, coordinate closely, and sustain trust with clients.

Project delivery during Marino's presidency reflected both continuity and expansion. The firm maintained its specialized work in cultural, academic, and research facilities, while expanding its museum portfolio and supporting long-standing clients. Marino frequently remarked that the firm's ability to secure repeat work from architectural partners—in different states and on various project types—demonstrated the strength of its collaborative approach. One of his enduring points of pride was that architects who first hired Mueller Associates for local commissions later invited the firm to pursue work in other regions. Establishing new,

longstanding clients to sustain and expand Mueller's project portfolio was a priority.

Marino's presidency, which spanned 16 years, was characterized by careful stewardship, rather than abrupt change. He maintained the culture passed down by his predecessors, while also adapting to new conditions in practice, technology, and project delivery. He frequently described the challenge of balancing his engineering background with the broader responsibilities of the presidency: managing staff, sustaining client relationships, maintaining a steady project backlog, and guiding the firm's long-term direction.

In 2022, as Marino assumed the role of chairman of the board, he continued to support the firm's leadership, and remained actively involved in mentoring other engineers. He noted that the most consistent value throughout his 40-year career was the firm's dedication to clients, colleagues, and its own long-term success. He viewed this dedication as the defining characteristic of Mueller Associates.

Service Beyond the Firm

Beyond his professional accomplishments, during his tenure as president, Marino demonstrated a sustained commitment to community service. For six years he served on the Board of Directors for Special Olympics Maryland (SOMD), including a term as chairman. During his tenure, he brought the same collaborative leadership approach that characterized his work at Mueller to an organization dedicated to using sports to empower individuals with intellectual disabilities.

His involvement with the Engineering Society of Baltimore, where he served on the House Committee, reflected his dedication to strengthening the professional community

that had shaped his career. Marino also earned an MBA from Loyola University Maryland—an achievement that enhanced his ability to guide the firm through strategic initiatives. Marino's reputation in academic engineering circles was further recognized when he was named a Penn State AE Fellow: an honor bestowed in 2010, during the centennial year of the university's Architectural Engineering (AE) program.

“COLOR US INVISIBLE”: ENGINEERING AS ART

The early 2000s also marked a period during which Mueller Associates began to articulate its identity more deliberately, through targeted marketing initiatives. Two campaigns—“Color Us Invisible” and “Go Wild”—were developed to communicate the firm's longstanding values, and to reflect the range of institutional work that had become central to its practice.

The origins of the Color Us Invisible campaign can be traced back to a moment in the firm's offices that captures both its culture and practice. During a routine project review, President Bob Marino was observed using colored pencils to trace systems on drawings laid out across his desk. When asked about this practice, Marino explained that, early in his career, he learned to visualize systems in color, in order to understand their relationship to the building's architecture and other elements.

Moreover, he also noted that the best measure of Mueller's work was that these systems ultimately disappeared into the built environment. As he put it, the firm's goal was always to keep its engineering “functionally essential, yet visually unobtrusive”: systems that operate “reliably, qui-



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etly, and without drawing attention.” This internal practice served as the conceptual basis for the Color Us Invisible promotion, which framed the firm’s work in cultural and historic environments as intentionally discreet.

The marketing campaign featured a series of printed postcards that combined colored-pencil graphics with imagery of museum galleries and historical interiors. On the front of each postcard, overlaid on a background of detailed engineering drawings, the words, “Color Us . . . Invisible,” appeared prominently, accompanied by a set of

actual colored pencils, referencing the campaign’s original inspiration. The museum postcard, for example, featured a view of the Smithsonian Institution’s Sant Ocean Hall—a large exhibition gallery at the National Museum of Natural History with a whale model suspended overhead—and the following paragraph:

“You may not notice our work, and that’s OK with us. Mueller Associates’ mechanical, electrical, plumbing, and fire protection systems are designed to protect historic environments quietly and efficiently.”

A parallel version of the postcard for historic-preservation projects carried a similar message, noting that Mueller’s systems are designed to “protect historic environments quietly and efficiently.”

The reverse sides of the postcards further emphasized the firm’s extensive experience in both museum and historic-preservation projects. It listed a broad range of project sites, including the Baltimore Museum of Art, the Walters Art Museum, the Smithsonian National Air and Space Museum, the Smithsonian National Museum of Natural History, and Winterthur, among many others. Likewise, the historic-preservation card included U.S. national landmarks.

As part of the campaign, the postcards were accompanied by branded sets of colored pencils, a direct reference to Marino’s original drawing-review practice, and an understated symbol of the firm’s belief that practical—and effective—engineering often remains unseen. The campaign’s visual elements reinforced a message long understood internally: that technical excellence, especially in museums and historic structures, is expressed through minimal visual impact, along with systems that seamlessly support the building’s architectural and programming needs.

TAMING COMPLEX PROJECTS: “GO WILD!” AT THE SMITHSONIAN NATIONAL ZOO

The “Go Wild!” marketing campaign was launched in 2013, in collaboration with Quinn Evans, for the International Association of Museum Facility Administrators (IAMFA) annual conference, held that year in Washington, D.C. The theme grew out of the conference’s scheduled “Zoo Day” event at the Smithsonian’s National Zoo—where Mueller Associates and Quinn Evans had completed numerous projects—and offered both firms an opportunity to highlight their specialized experience in zoo and museum environments.

Rather than relying upon traditional marketing gimmicks, the team jointly developed a field-ready promotional package, specifically for delegates on the tour. The giveaway consisted of a branded insulated cooler bag filled with water bottles, trail mix, animal crackers, gummy animals, and a printed card, all featuring the “Go Wild!” slogan and safari-style graphics. The cooler bags and all enclosed items were coordinated with the orange, black, and green color palette used in the conference advertisement published in *Papyrus*, IAMFA’s magazine.

The campaign’s messaging connected the zoo theme to the team’s ability to manage complex museum and zoological projects. Phrases such as “Wild expectations? No problem,” and references to “taming complex projects” appeared across the promotional card and lunch-bag insert. A full-page advertisement in *Papyrus* extended this same theme.

Feedback from conference attendees and Smithsonian staff was overwhelmingly positive. The Smithsonian’s representatives described the campaign as “a huge hit” and “thor-



oughly comprehensive,” noting that the bags were not only used all day, but continued to be used after the conference. They also acknowledged the team’s long record of performance excellence on the Zoo’s most challenging projects. Additional outcomes of the promotion included new qualification requests for museum work, and follow-up project opportunities, including museum energy audits and continued planning efforts for the Zoo’s Bird House renewal, which is described in greater detail in **Chapter 12**.

Although the “Go Wild!” campaign differed in tone from “Color Us Invisible,” both communicated complementary aspects of the Mueller Associates identity. Both highlighted the firm’s adaptability, creativity, and collaborative spirit, especially in environments where technical requirements and architectural character can be equally demanding, reinforcing Mueller’s longstanding relationships with cultural and institutional clients.



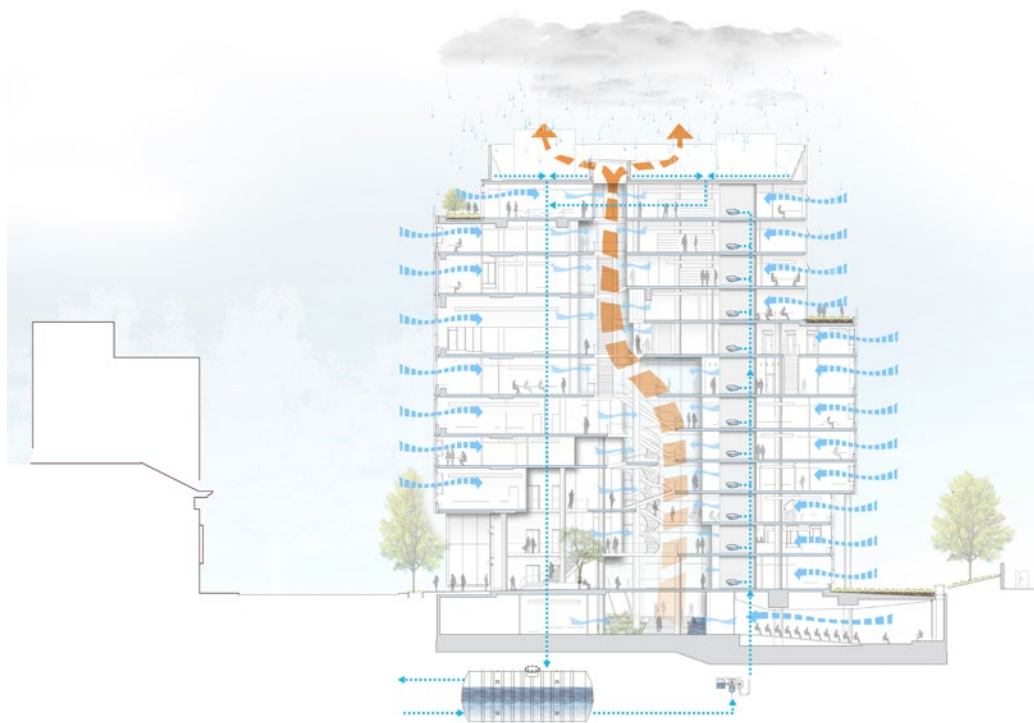
CHAPTER 8

Masters of Complexity

During just two years—2013 and 2014—Mueller Associates completed four significant capital projects. They totaled nearly 600,000 square feet, represented hundreds of millions of dollars in construction, and ranged from new buildings, to historic preservation, and complex renovations.

In April 2013, as the University of Baltimore’s new LEED Platinum law center opened its doors, a sophisticated ballet of systems hummed invisibly within its walls. An advanced natural-ventilation system sensed outdoor ambient conditions, automatically opening and closing 400 windows, and energizing atrium exhaust fans. Radiant tubing for both heating and cooling, embedded in concrete slabs, maintained indoor temperatures through thermal mass, rather than through forced-air systems. Custom manifold boxes regulated water flow via a three-dimensional puzzle of interlocking architectural forms.

That same month, one hour south in Washington, D.C., the headquarters for the National Academy of Sciences reopened after a comprehensive modernization—its 1924 Bertram Grosvenor Goodhue masterpiece now equipped with 21st-century systems that achieved LEED Gold certification, while preserving every detail of its historical fabric.



An environmental section diagram of the University of Baltimore's Angelos Law Center illustrates the building's natural ventilation strategy. Fresh air enters at every floor level; warm air exhausts through the atrium and roof; and rainwater collects below grade: a complete cycle, engineered to remain invisible.

In 2014, for the University of Maryland, Baltimore County (UMBC), Mueller's engineers were solving an entirely different puzzle: designing mechanical systems for a 176,000-square-foot performing arts facility.

Meanwhile, at the Baltimore Museum of Art, the firm orchestrated the transformation of a 40,000 square-foot renovation, while keeping the Museum operational during its centennial year. The challenge included protecting 97,000 works of art—including the world's largest public Matisse collection—with state-of-the-art climate controls and building automation systems.

These projects were complexity mastered, representing where Mueller Associates had arrived after nearly five decades of evolution.

The path to these achievements had been neither straight nor easy. The firm that emerged from the EA Engineering years had made strategic choices: investing early in BIM and Revit when others hesitated, pursuing LEED certification when sustainable design was still novel, and building relationships with prestigious clients through decades of reliable service.

By the 2010s, these investments were converging. Although BIM modeling was expensive, it now enabled coordination that had been difficult using traditional means. Sustainable and energy-efficient design expertise gained from earlier projects had now positioned Mueller for breakthrough commissions. The institutional relationships carefully maintained over the previous decades now yielded landmark projects at the highest levels of academic and cultural life.



ENGINEERING A THREE-DIMENSIONAL CHESS GAME: THE JOHN AND FRANCES ANGELOS LAW CENTER

In the late 2000s, when the University of Baltimore (UB) announced plans for a new law school building, campus administrators recognized the project's potential to transform far more than an academic program. Its location, adjacent to a prominent intersection in the historic Mount Vernon neighborhood, was also visible from the busy Jones Falls Expressway (I-83), as well as the nearby Beaux-Arts passenger-rail hub at Penn Station. This would enable the new Law Center to function as a highly visible gateway to the campus, and a landmark within the urban community. More than that, however, university leaders envisioned a building that would itself become an educational tool, teaching critical lessons about sustainability.

In a bold move that signaled its ambitions, the University sponsored an international design competition. Announced in November 2008, the new **John and Frances Angelos Law Center** project attracted submissions from architecture firms worldwide, each proposing a vision for what university officials hoped would become an iconic building for Baltimore. The selection of Behnisch Architekten—known for their work on sustainable academic buildings, including projects at Harvard and the Geisel School of Medicine at Dartmouth—and Baltimore-based Ayers Saint Gross, indicated the University's commitment to creating not just a functional building, but also an architectural statement that would elevate the institution's profile.

“The site of the Angelos Law Center is consistent with a core educational value: innovation,” said then-university President Robert Bogomolny, when announcing the selection. “Free of any limiting or defining architectural context, and on a location that will be viewed from all sides, the building’s impact cannot be maximized using traditional approaches.”

For Mueller Associates, the University’s decision to pursue LEED Platinum certification—making this the first law-school building in the U.S. to achieve that distinction—represented both an honor and a monumental challenge. The architectural team proposed concepts for a 12-story tower, featuring a striking composition of three interlocking forms clustered around a soaring, full-height atrium, with airy, light-filled spaces for the law library, moot court, classrooms, offices, and publicly accessible law clinics. Bringing this vision to life, while achieving the highest level of sustainable performance, would require Mueller to marshal every tool in its arsenal.

Interlocking Ambitions

Architect Stefan Behnisch described his firm’s design as “essentially three buildings in one,” with a composition that resembled “a complex, three-dimensional chess game.” The interlocking L-shaped blocks created what Behnisch envisioned as an artfully assembled puzzle, with each move in the design requiring careful consideration of its impact on every other element.

Lawrence Biemiller, a longtime senior writer at *The Chronicle of Higher Education*, who grew up in Baltimore, captured the building’s essence: “It’s the Escheresque interior that is the real prize. A bright—and brightly colored—atrium winds up through the middle, with bridges and staircases zigzagging

and spiraling through the space, in patterns as quirky as the law itself.”

This architectural complexity defined the project’s engineering challenge. Every system needed to be integrated into a building form that defied conventional approaches. Every solution needed to respect the clean, contemporary aesthetic envisioned by the architects. And every design decision needed to serve UB’s educational mission.

The architectural team’s extensive use of glass throughout the 192,390-square-foot structure added another layer of meaning and complexity. Day and night, the building made a statement with its transparency—clarity, unity, and community: values essential to legal education and profession. But this transparency also meant that Mueller’s engineering systems could not hide behind concrete walls, floors, and ceiling spaces. The engineering would need to be as elegant as it was intentional.

Technology Meets Complexity

Mueller Associates’ approach to the Angelos Law Center demonstrated how the firm’s earlier investments in technology were paying dividends.

Relying heavily upon Revit, Mueller’s engineers could navigate the three-dimensional chessboard created by the architectural team. For example, BIM software enabled precise modeling of how 11-inch-thick structural slabs would accommodate a cornucopia of infrastructure. This infrastructure included the Uponor radiant system’s PEX hydronic tubing, power and lighting conduits, HVAC temperature controls, automated window shade and actuation conduits, security conduits, audiovisual conduits, and steel reinforcement systems for concrete.

Every Inch of Space Mattered

The complexity of the coordination lay in the details, such as the building's 177 custom-designed manifold boxes for the radiant heating and cooling system. Most of these boxes were on the underside of ceiling slabs, requiring Mueller's engineers to carefully design around architectural features, the building's structure, ductwork, and piping, while maintaining accessibility for upkeep. Boxes in the walls were embedded around whiteboards and systems furniture. But this was not just engineering: it was three-dimensional problem-solving at its most intricate.

The design and location of displacement-ventilation diffusers also reflected the firm's attention to detail. In the moot court, custom bamboo diffusers along the perimeter matched the room's bamboo floors, with extruded-aluminum grilles and under-seat diffusers providing low-velocity displacement ventilation. BIM enabled Mueller's engineers to precisely position these elements around seating and floor supports. Exposed spiral fin-tube elements for atrium heating were among the architectural features. Even the millwork became part of the mechanical system, with custom casework on lower floors housing fin-tube heating elements and wire management, while pedestal enclosures on upper library floors presented a clean aesthetic, while accommodating perimeter heating.

Radiant Innovation: The TABS System

At the heart of Mueller Associates' engineering design was a radiant heating and cooling system that was relatively uncommon in North American commercial construction, although more common in European practice. The thermally activated building slab (TABS) system embedded hydronic PEX tubing directly into the building's concrete slabs, using

sensors to detect slab surface temperature, air temperature, and humidity. Control valves in the manifold boxes regulated water flow through the tubing, allowing the thermal mass of the concrete structure to moderate temperature swings and reduce heating and cooling loads.

The elegance of this approach lay in the fact that it eliminated as much as it added. By using radiant heat transfer through the building's structure, Mueller's engineers could significantly reduce ductwork in many areas, eliminate the noise and drafts associated with forced-air systems, and achieve the thermal comfort that occupants often enjoy without consciously realizing it.

The system's effectiveness depended upon sophisticated control strategies that accounted for the thermal lag inherent in heating or cooling a concrete slab, and on avoiding water temperatures that could cause surface condensation. This approach required Mueller's engineers to anticipate building loads and adjust systems proactively, rather than reactively.

Ventilation and Controls

But radiant systems have limitations. They cannot address latent cooling loads, or provide the ventilation required by building codes and healthy indoor environments.

Mueller's engineers addressed these issues through dedicated outdoor air systems (DOAS), featuring total-energy-recovery wheels that use exhaust air to preheat or precool incoming fresh air, and passive desiccant wheels to reduce humidity. The result was a hybrid approach leveraging the strengths of multiple technologies: radiant systems for heating and cooling, DOAS for ventilation and dehumidification, and displacement ventilation for larger spaces.

Perhaps the most visible manifestation of the building's sustainable sophistication is its automated natural ventilation system. The 400 windows throughout the Angelos Law Center serve as vents, opening and closing automatically, depending on outdoor ambient temperature and relative humidity. Actuators and controls enable the building to capitalize upon favorable weather conditions, reducing reliance on mechanical cooling, while providing occupants with the psychological and physiological benefits of outdoor air and natural ventilation.

"The natural-ventilation control strategy will save energy by minimizing the operation of air-conditioning equipment when outdoor air ventilation can provide adequate comfort," John Morris, Mueller's senior vice president and project manager, said at the time. The system's intelligence lay not only in when it operated, but also in how it interacted with other building systems.

Five high-capacity exhaust fans, at the top of the full-height atrium, supplement automated natural ventilation, using the atrium as a ventilation pathway for the entire building. Occupants in private offices can override the automated system if they see a green light, thereby maintaining individual control within an intelligently managed building system.

The automated shade-control system features similar sophistication. Operable shades within the façade, positioned between the curtain wall and the elaborate glass rainscreen system, are activated by rooftop solar sensors that track solar radiation. Morris noted that the shades "will save energy by minimizing solar heat gain, and by reflecting daylight into the building to reduce reliance on interior lighting systems." The building's audiovisual system is also integrated with shade controls, enabling automatic adjustments for various presentation scenarios. This integration

of multiple systems—mechanical, electrical, controls, and audiovisual—reflects the kind of holistic thinking that separates good engineering from exceptional engineering.

Beyond Energy Metrics

Architect Stefan Behnisch had long articulated a philosophy of sustainability that went beyond simple energy metrics. In discussing a similar project in 2006, he told *The Harvard Gazette*, "First, we have to define sustainability. Most people consider it a quantitative problem—the amount of energy used—but it is also a qualitative problem. It is about the usage of the building. First and foremost, a building needs to fulfill its purpose. To do that it should optimize its energy use."

This philosophy permeated the Angelos Law Center project. The building was designed to achieve 43% energy-cost savings, compared to an ASHRAE 90.1-2004 baseline building, with an annual site energy-use intensity of 40 kBtu/sf (approximately 125 kWh/m²). But these impressive numbers tell only part of the story. The real measure of success lies in how well the building serves its educational mission, while achieving these performance metrics.

When the Angelos Law Center opened, it immediately earned recognition as a landmark achievement in sustainable design. LEED Platinum certification confirmed what the design team had worked toward: this was the first law-school building in the U.S. to achieve the highest level of environmental performance. The Wintergreen Award from the USGBC Maryland chapter followed, along with a national Best of the Best Award in Higher Education from *Engineering News-Record*, and the USGBC's President's Award for Leadership and Vision. Ultimately, the project received more than 20 design and construction awards.



For Mueller Associates, the Angelos Law Center represents a watershed moment in the firm's evolution. The project demonstrates mastery of the complex challenges inherent in high-performance sustainable design, including the ability to integrate multiple sophisticated systems, balance competing objectives, coordinate with international design teams, and deliver buildings that exceed client expectations, while setting new standards for environmental performance.

The expertise garnered on the Angelos Law Center project would further inform Mueller Associates' subsequent work on other complex buildings, from performing arts centers and museums, to historic-preservation challenges.



Mueller Associates' solutions transformed an architecturally daring design into the first LEED Platinum law school in the United States, mastering a three-dimensional puzzle that conventional engineering approaches would not have been able to solve.



REIMAGINING A NATIONAL TREASURE: THE NATIONAL ACADEMY OF SCIENCES

The same month that the John and Frances Angelos Law Center opened, another landmark project reached completion one hour south, although this one had required an entirely different kind of mastery. Where the Angelos Law Center represented the cutting edge of sustainable design in new construction, the **National Academy of Sciences** (NAS) headquarters demanded that Mueller's engineers integrate 21st-century systems into a 1920s architectural masterpiece, without disturbing a single historical detail. If the UB Law School project showcased innovation in contemporary engineering, the National Academy of Sciences project would prove Mueller's ability to make modern systems disappear entirely.

On March 3, 1863, at the height of the U.S. Civil War, President Abraham Lincoln signed into law an Act of Congress establishing NAS. The Academy came into being with 50 charter members, all distinguished scientists who would provide independent scientific and technological advice to the federal government.

NAS emerged from discussions among scientists in Washington, D.C., about the need for a national scientific body. Although Joseph Henry, the first Secretary of the Smithsonian Institution, initially had reservations about the secretive negotiations surrounding the Academy's founding, he became convinced that "if well conducted," it



The National Academy of Sciences headquarters: Goodhue's restrained marble exterior at dusk (opposite), and the Great Hall within. One building, two revelations, and throughout both, Mueller Associates' systems invisible.

would “produce important results in the way of advancing American science and also in serving the government.” Henry became president of NAS in 1868, and served until his death a decade later, establishing Washington, D.C., as the Academy’s permanent home, and reinforcing its role as a scientific advisor to the federal government.

Despite the location of its leadership in the nation’s capital, NAS lacked permanent headquarters. Its first meeting took place in April 1863, in a chapel at the University of the City of New York (now New York University), with subsequent gatherings at various locations. The need for permanent headquarters grew more urgent after World War I, when President Woodrow Wilson established the National Research Council, as an arm of NAS, to advise on the practical use of scientific discoveries. In 1919, the Carnegie Corporation decided that, if NAS was able to purchase a building site via other means, it would finance construction and endow NAS.

The U.S. Commission of Fine Arts in Washington, D.C., informally suggested Bertram Grosvenor Goodhue as the architect for the new building. The Building Committee Chairman for NAS, George Ellery Hale—a prominent solar physicist who admired Goodhue—played a key role in the planning process. An anti-classicist by nature, Goodhue hoped to locate the building site farther from the National Mall’s burgeoning monumental core, to allow for a more flexible design.

Upon learning of the proposed location, Goodhue even recommended hiring a different architect! Despite the location for NAS, Goodhue designed a building with classical massing, lacking columns or pediments, that also complemented the Lincoln Memorial just 1,000 feet to the south. Goodhue declared that the building was a “modern and

scientific building, built with modern and scientific materials, by modern and scientific methods, for a modern and scientific clientele.”

The building’s architecture represented a unique interpretation of Neoclassical style, harmoniously weaving together Hellenic, Byzantine, and Egyptian influences, with hints of Art Deco. Goodhue’s design integrated sculpture, mosaic tile, and color in its architectural detailing. The façade’s warm-toned white New York Dover marble was cut into many different sizes, and laid in recessed courses to form a rough stone wall that has mellowed to pale gold over time. At the building’s center, the Great Hall featured decorations designed and painted by Hildreth Meière, with images and symbols of the Sun and planets, various scientific disciplines, historical academies, and the Four Elements: Earth, Air, Fire, and Water. The space also featured the mural *Prometheus* by artist Albert Herter, and bronze work by architectural sculptor Lee Lawrie.

The dedication on April 28, 1924, was described in the *NAS Annual Report* for that year as “simple but impressive.” It was attended by more than 600 guests—including 106 of the Academy’s 210 members, and representatives from Congress, the diplomatic corps, and the Carnegie Corporation. President Calvin Coolidge delivered the keynote address, referring to the building as a “Temple of Science.” Tragically, Goodhue had died just days before the dedication, leaving behind—as his only commission in Washington, D.C.—what many considered his finest work: a building that has now served as the home of NAS for more than a century.

Evolution and Expansion

As the Academy evolved and its mission grew, so did its physical home. The building underwent significant expansion between 1962 and 1970, when American Institute of Architects (AIA) Gold medalist Wallace Harrison—from the Modernist firm Harrison & Abramovitz, who had once worked as a draftsman in Goodhue’s office—designed additions to the east, west, and north wings. Completed in 1962, 1965, and 1970, respectively, Harrison’s compatible wings used the same marble with bronze window trim as in Goodhue’s original block, while incorporating Modernist sensibilities. The transformation reflected the Academy’s evolution from a closed society dispensing scientific knowledge to the government, to an organization adopting an increasingly public-facing mission that included hosting public proceedings and supporting multidisciplinary discourse on science, medicine, and engineering.

By the early 21st century, this architectural complex, now listed on the National Register of Historic Places, faced age-related challenges. Although the building’s historical fabric remained intact, its mechanical, electrical, and plumbing systems had become outdated and inefficient. The 190,000-square-foot landmark had reached a critical juncture. The Academy required a comprehensive modernization to restore the building’s historic grandeur, improve accessibility, accommodate increased public visitation, and integrate sustainable technologies, all while preserving the architectural integrity that made it a national treasure.

The Privilege and the Challenge

When Todd Garing, then a vice president and principal at Mueller Associates, was assigned to lead the engineering team in a comprehensive modernization of the NAS

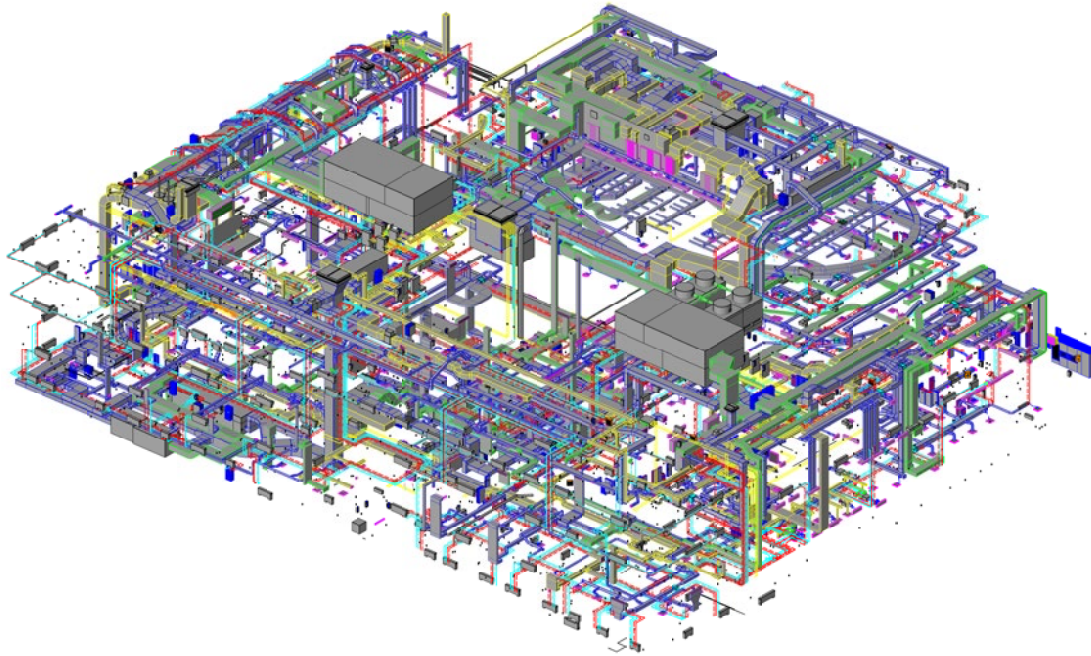
headquarters, he recognized both the privilege and the challenge it represented. Working with 29 subconsultants, coordinated by the architectural team at Quinn Evans—from skylight specialists to conservators of historical materials—Mueller would need to seamlessly integrate new MEP systems, while also respecting one of Washington’s most significant historic buildings. “This is the National Academy of Sciences, so naturally we tried to be as energy efficient as practical,” Garing recalled.

The design challenge was complex: how to serve a building that had transitioned into a conference center hosting public proceedings and large meetings, while preserving the integrity of its architectural fabric and integrated art. The building had grown to feature executive offices, meeting rooms, a 500-seat auditorium, workspace for 140 staff, a cafeteria, and a library.

Modeling the Unmappable

The comprehensive renovation would need to provide adequate space to accommodate the Academy’s expanded public mission, while maintaining the building’s architectural character. Mueller’s engineers began by conducting extensive assessments of existing conditions. “The project involved a lot of detailed survey work, including many onsite investigations,” said Garing. The challenge was considerable: how to integrate modern systems within the confines of a historic structure comprising multiple architectural periods, while also preserving its integrity.

“The building had been added onto multiple times, but all a long time ago,” Garing added. “The entire building was historic. Piecing together the original building, the additions, and the wings, and how they all related to each other . . . each was a completely different structure.”



The Revit coordination model for the National Academy of Sciences headquarters. Where the building's exterior revealed a 1924 Goodhue masterpiece unchanged, this model showed what was required to keep it that way.

From the project's inception in February 2008, Garing and his team recognized that Revit and BIM would be crucial to success. The integrated BIM model encompassed information from all disciplines, and was vital to integrating systems with the building's historic art and architecture. "The Revit model was absolutely essential," said Garing. "Because space was so tight, everything was modeled—all the piping, the ductwork, the structure. It really helped us coordinate all the pieces of the project." Multiple scenarios and design ideas were developed and reviewed, with input from the entire consulting team, to finalize the design.

Engineering for Variable Demand

Understanding the building's unique operational needs was crucial to the design approach. NAS headquarters operates with highly variable occupancy patterns. Although it has

numerous offices, most are occupied intermittently, when members travel to Washington for meetings and events, rather than serving as daily workspaces. "The building functions much like a conference center," noted Garing. "NAS hosts many events throughout the year, and members use the offices as a home base when they're in D.C. But there are extended periods of light occupancy." This pattern of fluctuations in use required systems capable of responding dynamically to actual demand. "You don't want to be maintaining full environmental conditions for spaces that aren't being used," said Garing. "The systems need to be intelligent enough to scale back during low-occupancy periods, while quickly ramping up to support large gatherings."

This operational reality drove critical design decisions. The existing three-pipe fan-coil units in most offices were highly inefficient, with heating and cooling water blended into a

single common pipe, wasting energy. Converting this into a traditional four-pipe system provided independent heating and cooling control, while eliminating thermal losses.

But the upgrade also presented substantial spatial challenges. “We had to route significantly more piping through these ornate historic spaces, without compromising the architectural fabric,” said Garing. The solution required creative collaboration with the architects. “We created new chases, and strategically moved interior walls inward to make pathways for the expanded piping infrastructure,” he added. “This project demanded constant problem-solving: examining every nook and cranny to determine where we could integrate modern systems without damaging historical elements. Each space required its own tailored solution.”

Innovation and Integration

The design of NAS’ new comprehensive mechanical systems included numerous energy-conservation measures. A 560-ton modular centrifugal water-cooled chiller, four cooling towers, and distribution pumps were installed. Mueller’s engineers designed three steam-to-hot-water converters, with a total capacity of 8,500 MBH, to extract heat from high-pressure steam supplied by the U.S. General Services Administration, and an instantaneous steam-fired hot-water heater for domestic hot-water service. The building is now conditioned by 11 variable-air-volume central air-handling systems, with a new humidity-control system protecting the Academy’s valuable archives. Additional energy-conserving features include dedicated outside-air systems for office areas, steam-condensate heat recovery, and a dedicated heat-recovery chiller.

In a particularly innovative addition, solar thermal collectors were installed on the roof to supplement the building’s

hot-water system. “It takes the sunlight, converts it into energy, and preheats the water before it gets to the steam converter,” said Garing. “There are times when the steam heat exchanger doesn’t have to run at all. On the days when there aren’t large meetings, domestic water isn’t needed as much, and the solar collector can handle the demand.”

The Great Hall Challenge

A notable challenge involved the Great Hall: the crown jewel in Goodhue’s 1924 design, and the ceremonial heart of the building. This magnificent space reflects Goodhue’s vision of a “Temple of Science,” as described by President Calvin Coolidge, with a 56-foot-high dome celebrating scientific knowledge. The dome’s iconography, titled “History of Science as Known in 1922,” was Hildreth Meière’s first major architectural commission, and a project that launched her distinguished 35-year career.

At the dome’s center, a stylized Sun is surrounded by symbols of the eight planets, as known in 1922, encircled by the inscription, “Ages and cycles of nature in ceaseless sequence moving.” Radiating outward, eight allegorical figures represent the scientific disciplines: Physics, Astronomy, Chemistry, Geology, Anthropology, Zoology, Botany, and Mathematics. At the dome’s rim, a second inscription dedicates the space “To science, pilot of industry, conqueror of disease, multiplier of the harvest, explorer of the universe, revealer of nature’s laws, eternal guide to truth.”

The dome rests on four pendentives, decorated with Art Deco-influenced figures representing the Four Elements, each surrounded by smaller medallions depicting inventions by humankind utilizing that element. The soffits of the arch display the insignia of four of the world’s oldest scientific academies—the Accademia dei Lincei in Rome, the Royal

Society in London, the Académie des Sciences in Paris, and the Alexandria National Museum in Egypt—along with symbols of their achievements, from Galileo’s telescope, to Newton’s prism, to the Pharos of Alexandria.

On the north wall, Albert Herter’s mural depicts Prometheus stealing the divine fire of Helios, while Lee Lawrie’s bronze work adorns the Hall’s fixtures and gates. The friezes and other integral works of art were executed entirely in painted and gilded raised gesso over R. Guastavino’s acoustical plaster: a technique developed specifically for this project to simulate colored glazed ceramic tile, while preserving the acoustical properties of the space.

Despite this magnificent artistry and careful acoustical design, maintaining proper environmental conditions in the Great Hall had proved historically difficult. A previous attempt at a solution had placed a mechanical unit on the roof, with ductwork that blocked off a quarter of the arched windows. This intervention had not only compromised the Hall’s carefully composed visual symmetry, but had also created acoustical problems in a space where sound quality was integral to the design.

Mueller Associates’ redesign eliminated this intrusive system, restored the Great Hall’s architectural and acoustical integrity, and finally achieved the precise climate control necessary to protect both the assembled scholars and the irreplaceable art.

Power, Light, and Lessons

NAS’ electrical systems underwent an equally comprehensive transformation. Mueller’s engineers replaced the service-entrance switchboard and all downstream equipment, upgrading the utilization voltage from 208Y/120V to

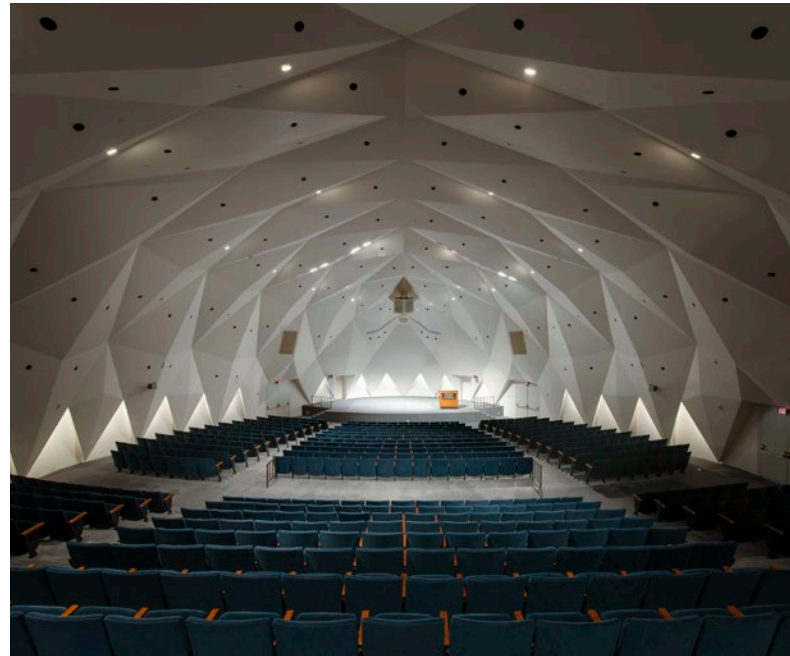
480Y/277V, in order to improve efficiency and capacity. The renovation incorporated new electrical and flexible lighting systems with local control panels, occupancy sensors, and a building automation system that dynamically sequences responses to occupancy patterns.

As a scientific organization, NAS was committed to making the building more energy efficient, and a demonstration of sustainable technologies. The courtyard skylights feature a 29,000 kWh building-integrated photovoltaic (BIPV) solar array that serves multiple functions simultaneously: generating electricity, yielding approximately \$3,000 in annual savings, reducing solar heat gain, and harvesting daylight.

“The BIPVs were viewed as a demonstration tool, rather than an attempt to obtain enough onsite generation for LEED credit,” said Garing. “They help shade the skylights, and make the glass perform better, because it doesn’t let in as much light. And the light that is hitting the glass is being turned into electricity.” Light shelves in the newly enclosed interior courts bring additional natural light into offices facing the atria, reducing the need for artificial lighting. In a particularly forward-thinking touch that aligns with the Academy’s educational mission, data from the photovoltaic system is displayed on the building’s monitoring system, making the sustainable technology both functional and pedagogical.

Conservation and Collaboration

Although Mueller Associates focused on the building’s systems, the broader renovation also included meticulous conservation of the historic works of art and architectural finishes. More than \$2 million was dedicated to the conservation process. Surfaces in the Great Hall were restored, including the cleaning of cast Akoustolith tiles, and



The enclosed interior court with its building-integrated photovoltaic array (left), the 500-seat auditorium (top right), and a boardroom (bottom right) at the National Academy of Sciences. Together they illustrate the building's dual identity: a historic landmark and a functioning modern conference center, its 21st-century systems invisible within Goodhue's 1924 fabric.

the cleaning, stabilization, and restoration of the glass and gesso ornamentation. Gilded surfaces were cleaned, and damaged gilding was replaced. Works by Herter and Meière were cleaned and conserved, including several canvas-backed murals. Conservators also restored decorative motifs and metal window trim and fittings, cleaned and refinished walnut paneling, and re-lamped, cleaned, and waxed bronze lighting fixtures. Mueller's engineering systems proceeded in concert with this delicate conservation effort.

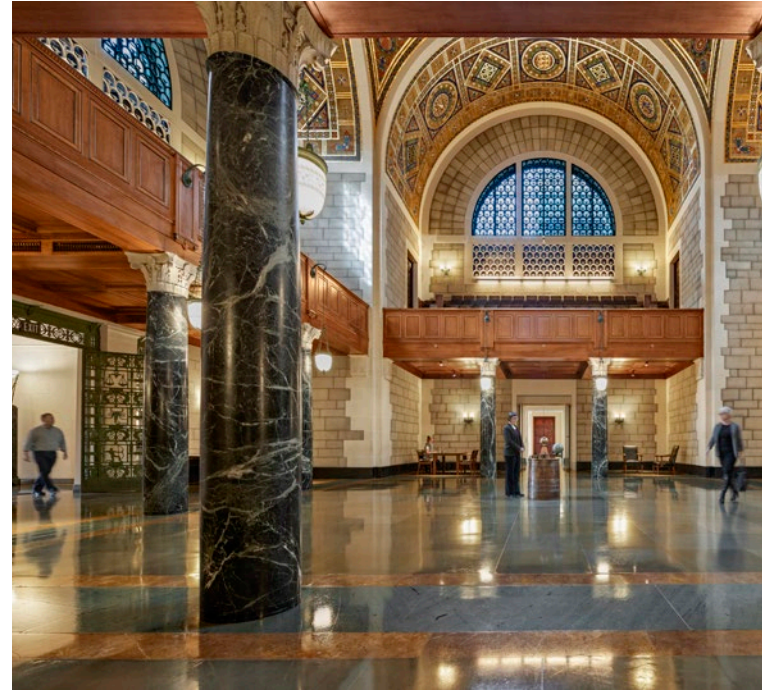
"The integration of contemporary systems was challenging," noted Larry Barr, then-President of Quinn Evans, "yet the solutions developed by Mueller were elegant and graceful, and had a minimal impact on the building's historical fabric."

Recognition and Transformation

The comprehensive renovation, completed in April 2013, achieved LEED Gold certification. Energy use was reduced by 26.7% relative to the building's previous performance. The project earned multiple awards, including an AIA Northern Virginia Award of Excellence, and a District of Columbia Award for Excellence in Historic Preservation. David Maloney, the District of Columbia State Historic Preservation Officer, commended the renovation as meeting "the highest standards of conservation" while serving as "an example for others to emulate."

Joe Papa, NAS Director of Operations for 17 years, witnessed the dramatic transformation. "Prior to the renovations, things were either on or off. Before, we didn't have adequate air conditioning. Now, we set our temperature right at 78°F, and every room is 78°F."

Reflecting upon these accomplishments, Garing said, "We take great pride in the successful completion of this



Goodhue's Great Hall after the 2013 renovation. Mueller's redesign eliminated a previous mechanical system that had blocked a quarter of the arched windows and compromised the Hall's acoustics.

project. NAS now has energy-efficient mechanical systems that respond to the varied demands of the building, and will serve them well for many years."

The renovation of NAS' headquarters is a testament to how modern engineering can revitalize historic structures and preserve their cultural significance. Through Mueller Associates' careful integration of contemporary engineering systems—coordinated seamlessly with conservation and preservation efforts across more than two dozen sub-disciplines—this landmark building continues its mission as a center for scientific advancement, and serves as a showcase for sustainable technology.



HARMONIZING SYSTEMS: THE PERFORMING ARTS AND HUMANITIES BUILDING AT THE UNIVERSITY OF MARYLAND, BALTIMORE COUNTY

As Mueller Associates expanded its presence within the higher-education sector in the early 2010s, few projects better exemplified the firm's growing technical expertise and problem-solving skills than the University of Maryland, Baltimore County (UMBC) **Performing Arts and Humanities Building** (PAHB).

Completed in two phases from 2012 to 2014, this landmark project was about much more than constructing a new building; it was a complex engineering challenge requiring both technical innovation and careful coordination across disciplines, while also supporting a highly diverse academic mission. The project's architectural design was led by

William Rawn Associates, a Boston-based firm known for cultural and performing arts facilities, with Grimm + Parker as the architect of record. For Mueller Associates, this was the first of several commissions with Rawn, ultimately leading to multiple award-winning projects in the years to come.

The vision for UMBC's PAHB arose from a campus master plan to consolidate and improve programs spread across several aging buildings. UMBC needed a facility to house five distinct academic departments—Theater, Music, Dance, English, and Philosophy—under one roof, each with unique and sometimes conflicting needs. Theater required complete acoustical isolation. Music needed near-perfect silence

for recording. Dance called for flexible, climate-controlled spaces. English and Philosophy sought quiet study areas. All of this had to be accomplished while creating performance venues that could serve both the university community and the wider public.

The project—20 years in the making—would serve as more than an academic facility. Positioned as a cultural gateway to campus, the building would elevate UMBC's profile in the arts.

Building Half a Puzzle at a Time

From the project's start in February 2008, the Mueller Associates engineering team recognized that the PAHB presented a unique challenge: the 176,000-square-foot facility would be designed as a single building, but constructed in two phases, each of which would operate independently, while allowing for eventual integration. As Tom Syvertsen, who served as both project manager and lead mechanical engineer, later recalled, "When you have that many different programs, it's a puzzle. And we were only building one half of the puzzle at a time."

This strategy—investing in thorough early design, even for spaces that would not be built for years—demonstrated Mueller's commitment to long-term planning over short-term gains.

Phase one, completed in 2012, brought to life the Department of English and, with it, writing labs, seminar rooms, and faculty offices. It also brought to life the Department of Theater, with its 275-seat proscenium theater, black box theater, scene shop, and costume production facilities; as well as the Dresher Center for Humanities. Phase two opened in 2014, and added the Department of



For UMBC, the project was built and designed in two phases, and the design development phase covered the full building concept. We had a vision for what the second phase would look like, while we were designing the construction documents for the first phase. We reached a certain level of design, so we could plan early on how systems would connect.

We had multiple air-handling units per phase, and those units generally adhered to the program. For example, in phase two, there was the music program and the concert hall. But, those are separate units. AHU-9 was the music unit, and AHU-11 served the concert hall; and both had winter-humidification requirements.

These units were separated based on the program's needs, the architecture, operating schedules, and acoustical requirements, to ensure that we maintain the desired humidity levels within each zone.

Tom Syvertsen

Music, featuring its centerpiece: a 350-seat concert hall. Phase two also included the Department of Dance, with specialized studios; and the Department of Philosophy's academic spaces. Each had unique requirements, necessitating a balance within a unified building-systems strategy.



Spaces in UMBC's Performing Arts and Humanities Building: the light-filled Dance Cube (left) and a rehearsal studio (right) equipped with a theatrical lighting grid. Designing systems for these spaces was a key part of Mueller's engineering challenge.

The Central Plant Solution

Although the building itself commanded attention, one of the project's most significant engineering achievements occurred largely out of sight, deep within UMBC's existing central utility plant. The original scope of the project called for a straightforward expansion: the addition of a new 1,000-ton chiller and cooling tower to serve the PAHB's substantial cooling loads. Initial cost estimates, however, revealed that expanding the plant building to accommodate this new equipment would add approximately \$1 million to the budget: a significant burden that threatened other project priorities.

Steven Gillis, who served as the project's principal-in-charge, saw an opportunity where others might have seen only a budget obstacle. The existing plant had reserved floor space for a future 1,000-ton chiller, in order to provide standby capacity if an existing chiller failed during peak demand. Rather than simply adding capacity for the new building, Gillis proposed a more ambitious solution: installing a single 2,000-ton duplex chiller within the existing plant footprint, thereby simultaneously addressing the new building's demands and the lack of standby capacity on the campus. "The central plant solution exemplified Mueller's approach to engineering challenges," Gillis said later. "Rather than simply adding capacity, we found a way to consolidate



Underfloor distribution systems are not particularly new. However, when assembling this type of system, it will always be a custom design. We faced the challenge of locating an air-handling unit with noisy fans very close to the concert hall. Issues can arise with any unique design. When you design it, you have all the calculations that say this will work. But then, when you actually sit in there with a house full of people, lights on, and it's quiet and comfortable, you know that it works, and it was a success.

Tom Syvertsen



To meet NC-15 noise criteria, Mueller routed air through a concrete acoustical expansion chamber, then delivered it at low velocity, through more than 250 floor devices beneath the concert hall's seats.

equipment, improve reliability, and enhance the existing systems simultaneously—all while avoiding costly expansions to the building.”

The solution extended beyond the chiller itself. Mueller’s engineering team designed a comprehensive upgrade that refurbished the six existing cooling towers with larger, more efficient motors and fans, new intake openings, drift eliminators, and fill. Variable-speed fan controls were installed to improve energy efficiency. The underground chilled-water distribution system received new piping that hydraulically looped existing mains, thereby improving flow to the most remote buildings. A new variable-speed primary pump was installed to enable future conversion from the existing constant-speed primary, and secondary distribution to a more efficient primary-only, variable-flow system.

The electrical infrastructure supporting the central plant underwent an equally dramatic transformation. Two aging 34.5kV oil circuit-breakers—equipment that had served the campus for decades—were replaced, along with all four transformers (two 34.5kV-13.2kV units, and two 34.5kV-4.16kV units). The entire 15kV switchgear was upgraded, and modifications were made to the 5kV switchgear supplying the chillers, as well as to the 1200-amp, 480-volt motor-control centers serving the cooling towers.

Acoustics and Innovation: The Concert Hall

If the central plant project demonstrated Mueller Associates’ strategic problem-solving on a campus-wide scale, the PAHB concert hall showcased the firm’s ability to balance seemingly conflicting requirements within a single room.

The 350-seat performance space had to meet NC-15 noise criteria—one of the strictest acoustical standards in building design—while efficiently managing substantial heat loads from performance lighting, and the varying occupancy loads typical of a multi-use venue.

As Syvertsen said: “For this project, we wanted to approach it differently. It was a brand-new facility. We had the opportunity to do an underfloor distribution system. When designing from scratch, this seemed like a great opportunity.”

Mueller’s engineering approach began with a single-zone variable-air-volume air-handling unit located near the concert hall which fed into an acoustical expansion chamber. This acoustical expansion chamber—essentially a large sound-attenuating plenum—dramatically reduces fan noise before air enters the distribution system. From there, supply air travels through oversized, acoustically lined ductwork to a segmented plenum located beneath the concert hall’s tiered seating.

More than 250 round floor devices, mounted flush with the floor beneath the seats, delivered conditioned air directly to occupants, at low velocity. “That’s a good way to feed a concert hall, because it delivers the air directly to the occupants,” Syvertsen noted. “It’s at a low velocity. It’s very quiet. That air rises as a plume toward the ceiling, taking body heat and contaminants with it, and it gets collected at the ceiling and routed back to the unit for filtration and conditioning.”

The air-handling configuration demonstrated innovative thinking. “The air-handling unit was a custom unit,” said Syvertsen, “with two air tunnels, one with traditional coils and filters. The other parallel tunnel filters the remaining portion of the return air. It mixes back together and provides air at 68°F, such that it’s not coming out at your ankles

at an uncomfortable 55°F.” This return-air blending strategy reduced reheat requirements, while maintaining occupant comfort: a sophisticated approach to energy conservation that operated invisibly in the background.

A Seamless Blend

The proof came shortly after phase two opened on August 31, 2014. Just days later, on September 5, the Miro Quartet performed the building’s first major concert, christening the space Mueller engineers had labored to perfect. UMBC President Freeman Hrabowski attended, and noted how the building embodied what he had envisioned: “We wanted a building that said something about who we are as a University, and our values as a community.” The concert hall’s retractable seating, accommodating 250 to 350 people depending on the event, and the black box theater’s intimate 125-seat configuration, would host countless performances in the years ahead—each a testament to the acoustical precision Mueller had achieved.

UMBC’s PAHB showcases what can be achieved when engineering excellence supports both artistic and academic missions. The project reflects Mueller Associates’ approach to tackling complex challenges: understanding core requirements, questioning traditional solutions, coordinating across disciplines, and creating systems that work both on paper and in practice. Additionally, the PAHB project proved that technical excellence in building systems can bolster artistic expression and academic success: a seamless blend of engineering and architecture that will serve UMBC’s mission for generations to come.



PROTECTING PRICELESS HERITAGE: THE BALTIMORE MUSEUM OF ART

In the storied history of Mueller Associates, few institutional relationships showcase the firm's engineering excellence and dedication to cultural preservation as clearly as its five-decade partnership with the **Baltimore Museum of Art** (BMA).

Starting in 1975 with an environmental control study—an essential project for protecting priceless works of art—Mueller Associates initiated one of its most enduring collaborations. Over nearly 50 years, the firm has completed more than 40 projects for the BMA, establishing a tradition of long-term client relationships grounded in trust, expertise, and a steadfast commitment to preserving cultural

heritage. This partnership has proven the firm's capabilities in museum environmental engineering at the highest level, as Mueller's engineers have learned to balance the strict demands of art conservation with the challenges of maintaining a historic building complex that has evolved across more than a century of American architecture.

But to appreciate the importance of this collaboration, one must first understand this remarkable institution.

From Fire to Cultural Renaissance

In February 1904, the Great Baltimore Fire destroyed much of the city's downtown business district, burning more than 1,500 buildings and leaving 70 city blocks in ruins. Yet, from this disaster, Baltimore's civic leaders developed a firm resolve that their city would not just be rebuilt; it would be transformed into a major cultural hub. Dr. A.R.L. Dohme, who led the city-wide congress responsible for planning Baltimore's recovery, recognized a key shortcoming: the absence of an art museum. This realization led to the creation of an 18-member Committee on the Art Museum. After ten years of planning and fundraising, the BMA was officially incorporated on November 16, 1914.

The possibility of establishing an art museum in Baltimore had long been widely discussed by the city's political, business, and cultural elite. During the summer of 1911, a committee, appointed by Dr. Dohme, spent considerable time in exhaustive research, studying museums in other American cities. In October 1913, Dr. Dohme called another meeting to discuss the project, appointing a larger committee to conduct further investigations. By Spring 1914, this committee had adopted articles of incorporation, selecting prominent Baltimore civic leaders as incorporators.

Dr. Dohme articulated an expansive vision for the institution's educational mission. In a November 1914 address, he emphasized that the Museum would serve not merely "those who love art," but also "those who do not yet know they are going to love it." He stressed the Museum's importance "in connection with the schools, especially for historical study and also in the industrial field," noting that manufacturers, textile-trade journalists, and department store buyers would find educational value in studying art. The Museum, he believed, should help elevate public taste across all

segments of Baltimore society, from schoolchildren studying history to industrial designers seeking inspiration. The democratic approach of the BMA's founders would steer the Museum through its early stages, and ultimately define its role as a public institution.

The young Museum began with just one painting: William Sergeant Kendall's *Mischief*, donated by Dr. Dohme himself. The founders' belief in Baltimore's cultural future remained strong. The Peabody Institute at Johns Hopkins University agreed to temporarily house the fledgling collection, as plans for a permanent location progressed.

By 1915, the committee had chosen a site in Wyman Park, near the new Homewood campus of Johns Hopkins University. However, the Museum would spend another 14 years in temporary quarters before securing its permanent location. In July 1922, the collection relocated to the former mansion of Mary Elizabeth Garrett, at 101 West Monument Street in Baltimore's historic Mount Vernon neighborhood, where it opened to the public in 1923.

Garrett was the daughter of Baltimore and Ohio Railroad president John Work Garrett. A trailblazing philanthropist who funded the Johns Hopkins School of Medicine, after it began admitting women, she exemplified the civic-minded leadership that marked Baltimore's cultural and physical revival. The Museum's inaugural exhibition drew nearly 7,000 visitors in its first week: clear proof of the public's desire for cultural enrichment.

Pope's Temple and the Cone Legacy

The selection of John Russell Pope as architect for the BMA's permanent building was a significant win for the fledgling institution. Pope, who had studied at Columbia University



John Russell Pope's Baltimore Museum of Art, as illustrated in The Baltimore Sun on April 21, 1929. The Neoclassical landmark Mueller Associates would one day help preserve was, at that moment, brand new.

and the École des Beaux-Arts in Paris, was America's leading interpreter of the Classical Revival style of architecture. The BMA was his first museum commission, setting a pattern that would influence his later major projects, including additions to the Tate Gallery and British Museum in London, and ultimately the National Gallery of Art and the Jefferson Memorial, both in Washington, D.C. Pope's unique style of Classicism—serene, massive, and distinctly American—made him the ideal choice for Baltimore's ambitious venture.

The BMA's cornerstone was laid on October 20, 1927 and, on April 18, 1929, the Museum opened its doors in Pope's magnificent Neoclassical building at 10 Art Museum Drive. The 38,500-square-foot structure featured a symmetrical, biaxial plan with a central portico, interior galleries interwoven with quiet open spaces, and broad limestone walls interrupted by

niches and recessed panels. Critics and visitors alike marveled at Pope's achievement. One contemporary observer noted that, while some might debate individual architectural details, "there can be no question that the building is a work of conspicuous beauty and good taste."

The Museum's design earned praise for avoiding what critics called the "heaviness" often associated with Neoclassical architecture—instead achieving a lightness and grace that felt distinctly modern, despite its Classical vocabulary. The building's location in Wyman Park, with ample space for future expansion, demonstrated forward-thinking planning, as the Museum grew in the decades to come.

The opening week featured an inaugural exhibition composed largely of loans, since the Museum's permanent

collection was still being assembled. Highlights included works by contemporary artists, including paintings and prints, which drew particular attention from Baltimore's art community. More than 25,000 people visited within the first six months. Many were drawn by free admission: a practice reflecting the founders' democratic vision.

One week before the public opening, on April 21, 1929, Baltimore's art community was given a preview of the new facility. The art critic for *The Baltimore Sun*, writing about the inaugural exhibition, observed that, although the collection included works by Old Masters such as Rembrandt, Raphael, and Goya, the Museum's true potential lay not in borrowed treasures, but in the permanent collection it would build over time: one that would be shaped profoundly by gifts like those to come from the Cone sisters.

“My Two Baltimore Ladies”

The BMA's destiny was forever changed by two extraordinary women: Claribel Cone (1864–1929), a physician and professor of pathology; and Etta Cone (1870–1949), an accomplished pianist and household manager. Daughters of successful German-Jewish immigrants whose family had built a textile empire, in 1901 the sisters began traveling to Europe. Through their friendship with Gertrude Stein, they entered a circle of avant-garde artists in Paris. In 1905, Etta attended the Salon d'Automne, and met Pablo Picasso through Stein. The following year, she met Henri Matisse through Gertrude's sister-in-law, Sarah Stein. This meeting sparked a lifelong passion for collecting Matisse's art.

The Cone sisters began purchasing works directly from Matisse's studio in 1906, becoming among his earliest and most dedicated patrons. Matisse affectionately called them “my two Baltimore ladies,” and their relationship grew

stronger over the years. When Matisse painted his controversial *Large Reclining Nude* in 1935, he sent Etta 22 photographs documenting his process, knowing that she would purchase the finished piece to hang opposite Claribel's earlier acquisition, *Blue Nude (Souvenir de Biskra)*.

Their collection also comprised more than 114 works by Picasso, along with masterpieces by Cézanne, Gauguin, and van Gogh. The Cone Collection encompasses approximately 3,000 items in total, including textiles, decorative arts, and objects from Africa, Asia, and Europe. The Cone sisters displayed this remarkable collection in their connected apartments in the Marlborough building in the fashionable Bolton Hill neighborhood.

When Claribel died in 1929, she left her collection to her sister, Etta, with a notable condition: it should be donated to the BMA upon Etta's death, “if the spirit of appreciation of modern art in Baltimore should improve.” This provisional gift reflected the visionary outlook of both sisters, and the fact that their taste for avant-garde art was not yet universally accepted. (Art students had once burned the *Blue Nude* in effigy during a 1913 Chicago exhibition.)

Appreciation for modern art must have grown enough because, when Etta died in 1949, the entire Cone Collection was donated to the BMA. Since 1957, it has been displayed in the Cone Wing, making the BMA home to the world's most extensive public collection of works by Henri Matisse—now more than 1,600 items—while also establishing it as one of America's leading collections of Modern art.

Decades of Growth and Evolution

Starting in the 1950s, the BMA expanded significantly to accommodate its growing collection. The Saidie A. May

Wing opened in 1950, followed by the Woodward Jacobs Wing in 1956, and the Cone Wing in 1957, all designed by local architects to match Pope's original building. Additional expansions in 1982 and 1994 introduced modern design elements that contrasted sharply with Pope's Neoclassical style, while also providing space for modern and contemporary works of art.

In 2006, the Museum achieved its founders' democratic goal by eliminating general admission fees. Today, with a collection of 97,000 objects spanning cultures from Ancient Egypt to Contemporary art, the BMA attracts more than 200,000 visitors annually, offering free access to its galleries, and upholding its core belief that art should be integrated "into the lives of the citizens and their children."

A Partnership Forged in Precision

As an institution, the BMA—rich in history, architectural excellence, and world-class collections—requires the strictest conservation standards. Mueller's partnership with the institution demonstrates the firm's capabilities in museum environmental engineering at the highest level. The relationship began in 1975, with an environmental-control study. This initial project helped the firm understand the BMA's unique challenges in maintaining precise temperature, humidity, and air quality.

The BMA campus faces several unique challenges, given that its 10-building complex was constructed over a period of 65 years. Each expansion involved different construction standards, systems, and architectural styles, all of which had to be integrated into a unified design. Mueller's engineers have gained specialized knowledge of the Museum's campus, especially as it has grown. In the 1980s and 1990s, Mueller supported several major projects, including the Woodward

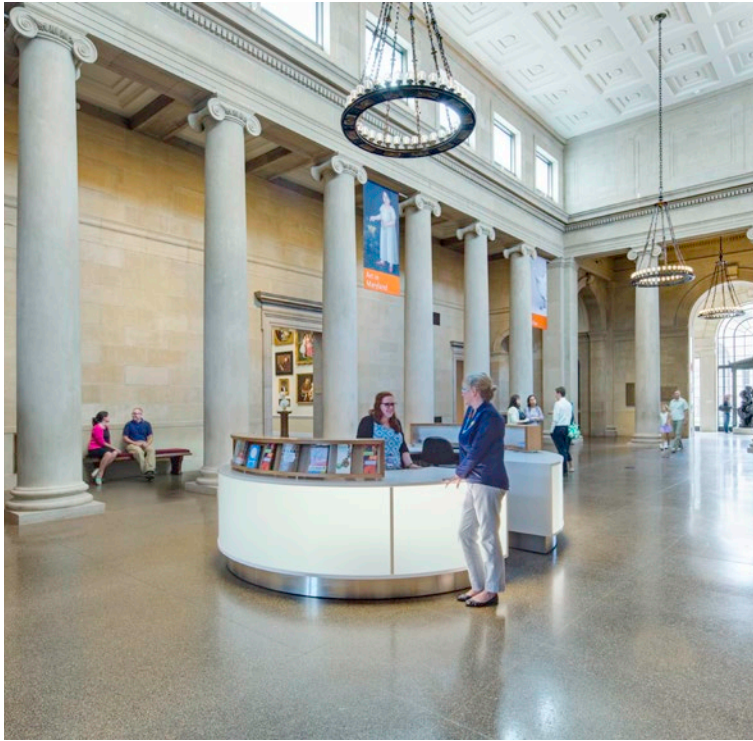
Jacobs Wing, the Museum Shop, and the Contemporary Wing. With each project, the firm's institutional knowledge increased, enabling more advanced approaches to the BMA's multifaceted needs. In the early 2000s, Mueller developed a comprehensive master plan for the Museum's systems and other key infrastructure projects.

The Centennial Transformation

The highlight of Mueller Associates' partnership with the BMA involved its centennial renovation program. From 2011 to 2014, this significant project transformed 40,000 square feet of the Museum's 210,000-square-foot complex. Mueller collaborated with Ziger | Snead Architects to plan major updates to the galleries displaying Contemporary, American, and African art, to improve the East Lobby, to reopen the historic entrance, and to develop new spaces, including a learning center.

What made this project remarkable was the engineering achievement that kept the Museum operational during construction. Careful phasing allowed visitors to continue enjoying the BMA collection while transformative work took place behind temporary walls and after hours. "The BMA has been an excellent steward of both its collections and its historic building," Steven Gillis, principal-in-charge of many of Mueller's BMA projects, has observed. "They have always been clear about their vision for providing an engaging environment where people can see and experience art."

The centennial renovation also included a state-of-the-art BAS that transformed the Museum's ability to protect its 97,000 works of art. The system provides unprecedented control over the preservation environment, maximizing energy efficiency while balancing conservation needs with sustainability objectives.



Mueller's engineering solutions during the Baltimore Museum of Art's centennial renovation, completed in 2014, threaded new climate-control and building automation systems through John Russell Pope's Neoclassical landmark—without closing the BMA's doors to the public.

The project's completion in November 2014 marked a transformation that touched upon every aspect of the visitor experience. The reopened galleries showcased not only refreshed displays of Contemporary, American, and African art, but also represented years of careful systems coordination: work that enabled the Museum to protect its treasures while welcoming the public without interruption.

During the centennial celebration, the engineering achievements remained largely invisible to visitors, who instead experienced the seamless result: perfectly preserved works of art in galleries maintained at precise environmental conditions, while the Museum continued its daily operations.

The success of this critical project further strengthened the partnership between the BMA and Mueller Associates. In subsequent years, the firm continued to support the BMA through targeted improvements, including updates to air-handling units, educational spaces, and specialized gallery environments.

Each BMA project presents distinct challenges, even within the same building complex. The Museum's 10-building campus—constructed over more than a century—means that a renovation in the historic Pope building requires very different strategies than work in the Jacobs Wing or other later additions.



We've worked on many projects at the BMA over the years. Each has been unique. The conditions we face when ceilings are removed and walls are opened up vary by area, reflecting different structural features that are often unique across various parts of the building. Our approach to those projects is to look behind the scenes, above the ceilings, and behind the walls, and tailor our systems and pathways to what will work best in those specific conditions, in order to meet the project's needs.

Clark Davenport

When opening up ceilings and walls, the conditions Mueller engineers encounter vary significantly across projects, requiring creative problem-solving and adaptability.

For these projects, Mueller engineers closely coordinate with BMA staff to support the Museum's ongoing operations. "We have always worked to ensure that the HVAC systems serving these renovation areas could be isolated, without having a negative impact on surrounding areas that remained open during the renovations," says Mueller Project Manager Clark Davenport. "Recent upgrades to air-handling units allow for greater system turndown, and more redundancy than the original equipment provided. Projects from the early 2010s have helped to modernize HVAC controls, offering better and more stable system control."

New Centers for Major Collections

In 2021, Mueller's expertise was essential to two of the BMA's most specialized projects: creation of the **Nancy Dorman and Stanley Mazaroff Center for the Study of Prints, Drawings and Photographs** (PDP Center) and the **Ruth R. Marder Center for Matisse Studies**, both designed by the architecture firm Quinn Evans. These renovations transformed 22,500 square feet of space into a new, improved, and more publicly accessible environment for the study and preservation of the Museum's extensive collection of works on paper.

The two projects also presented unique engineering challenges. Works on paper—which comprise two-thirds, or about 65,000 objects, of the BMA collection—are highly sensitive to environmental conditions. Mueller's engineers developed advanced climate-control systems to maintain the precise temperature, humidity, and air quality required to preserve these delicate items. Additionally, they designed specialized pre-action sprinkler and clean-agent fire-extinguishing systems to enhance the protection of this irreplaceable collection.

The roughly 7,000-square-foot PDP Center features dedicated spaces for temporary exhibitions, study rooms for academic and public programs, staff offices, enhanced storage, and publicly accessible work areas—each with specific environmental needs. Mueller's systems had to balance the preservation requirements of 57,000 prints, 4,000 drawings, and 4,000 photographs—collections from the 15th century to the present day—while also ensuring visitor comfort and operational efficiency.

The nearby Marder Center was established to provide scholars, curators, and visitors with access to the Museum's



The Franzoni arch, carved in 1813, is now a focal point of the BMA's Marder Center. When incorporated into the renovation's design, Mueller's engineers had to adapt by rerouting return ductwork through structural openings above the arch, rather than compromise a piece of Baltimore history.

collection of more than 1,000 prints, drawings, and illustrated books by Henri Matisse, this space required systems that would safeguard these masterpieces, while enabling their study and enjoyment. Mueller's careful integration of mechanical, electrical, plumbing, and fire-protection systems into the historic structure enables these treasures to be exhibited and examined safely.

One notable challenge demonstrated both the creativity needed, and Mueller's sensitivity in preserving Baltimore's architectural heritage. The PDP Center features a historical stone archway sculpted by Giuseppe Franzoni in 1813 for the Commercial and Farmer's Bank, which once stood at

Redwood and Howard Streets in downtown Baltimore. This rare surviving example of early American Neoclassical sculpture depicts Mercury, the Roman god of commerce, and Ceres, the goddess of agriculture. From 1813 to 1957, the two deities watched over the bank, until construction of the Baltimore Civic Center (now the CFG Bank Arena) required their removal. The Maryland Center for History and Culture preserved the archway until donating it to the BMA in 1967.

When Quinn Evans incorporated this vital piece of Baltimore history into the new Center's design, Mueller's engineers faced an unforeseen obstacle. Rather than compromising

either the building's historical features or the performance of modern systems, Mueller's engineers collaborated with the architectural team to develop creative solutions honoring both needs. The Franzoni arch now serves as one of the Center's focal points, its two-century journey from a downtown bank to a museum study center preserved intact, while Mueller's unseen systems ensure ideal conditions for the valuable works on paper that the Center helps to protect.

When the Marder Center opened in December 2021, it marked a homecoming for works that Matisse himself had created with Baltimore in mind. A community celebration on opening day featured storytelling, artmaking, performances, and free admission to the exhibition *A Modern Influence: Henri Matisse, Etta Cone, and Baltimore*, which ran through January 2, 2022.

One of the exhibition's revelations was how Matisse's relationship with Baltimore shaped his late work. After accepting Etta's invitation to visit the city in 1930—during which he saw how the sisters displayed his paintings in their apartments, and attended opening night at the opera, where the sisters wore Matisse-designed jewelry—the artist realized he could have a major American presence. He began creating works specifically with the Cone Collection in mind, offering Etta items he knew would complement works already in her possession. As former BMA Director Christopher Bedford observed about the exhibition, "Matisse is the artist whom more people visit a museum to see in Baltimore than perhaps any other city in the world."

A Legacy of Stewardship

Looking back over his career working on BMA projects, Davenport highlights the BMA's dedication: "It's clear that



For more than five decades, Mueller Associates has helped the BMA protect its collections and preserve its historic buildings through carefully integrated, largely unseen engineering.

stewardship of this facility is of the highest priority to administrators. The Museum has undertaken numerous projects over the decades, focusing on protecting its collections and enhancing the visitor experience. Keeping the Museum open while these projects are ongoing has also always been a priority."

The BMA's transformation from a traditional Neoclassical building, into a vibrant, modern museum capable of conserving and displaying world-class art, remains a legacy partnership for Mueller Associates, and an engineering feat worthy of the masterpieces safeguarded by the BMA. Mueller has played a key role in ensuring that the Museum achieves its original vision: bringing fine art into the lives of citizens and their children, now and for the future.



CHAPTER 9

Golden Anniversary and New Horizons

In 2016, the celebration of Mueller Associates' 50th anniversary marked more than a milestone; it represented a transformative moment that would profoundly shape the firm's future. After more than 30 years at 1401 South Edgewood Street in Baltimore—the custom-built headquarters where the firm had grown into a regional powerhouse—Mueller moved to new offices at 1306 Concourse Drive in Linthicum, near Baltimore-Washington International Airport. The distance was modest—just over five miles, a 15-minute drive—yet the move carried profound significance. This relocation symbolized far more than a change of address: it embodied the firm's journey from its humble origins to its position as a leader in complex institutional engineering.

The Edgewood Street office had been home to Mueller Associates through pivotal decades of growth, from the energy-crisis innovations of the 1970s and 1980s through the EA Engineering period in the early 1990s, to the sustainable design and technology revolution of the early 2000s. Within those walls, generations of engineers had been mentored, landmark projects had been designed, and the culture that Richard Mueller established had been preserved and strengthened.

through successive leadership transitions. Leaving this space meant honoring the past, while deliberately creating an environment for the firm's next chapters.

Mueller Associates did not make this decision lightly. President Bob Marino and the leadership team faced a delicate challenge: separating the firm from the building the founders had personally helped to develop and still owned. The conversation required careful navigation, balancing business needs with personal history and relationships spanning decades. Yet the decision reflected the firm's commitment to its future, even when it meant moving beyond a physical space so deeply connected to its origins. With the firm's 50th anniversary approaching, the time was right.

The new headquarters reflected everything Mueller Associates had now become. Senior Vice President John Morris, who oversaw the build-out, described the vision: "We are able to work more collaboratively in this office. Having everyone together on one floor, with easy access to all of our resources and technology, has been a big benefit." The physical transformation was significant: whereas the Edgewood Street office had spread the firm across one full floor and part of another, the new space unified everyone on a single level. The design embodied the firm's core values through an open, light-filled engineering studio. The engineers worked in a collaborative bullpen environment, with managers' offices positioned along the perimeter—a layout that reinforced accessibility and mentorship. Low-paneled workstations, dedicated resource areas, informal meeting spaces, conference and training rooms, and state-of-the-art presentation technology completed the vision.

The walls of the new office displayed framed photographs of landmark projects: a visual testimony to half a century of engineering excellence. But perhaps most telling was the

firm's new tagline, adapted for the anniversary: "Engineering Great Experiences." This simple phrase encapsulated Mueller's evolution from a technical-services provider to a firm which understood that its work shaped how people experience and interact with the built environment.

In addition, although it had not been part of the initial decision-making process, the new location offered an unexpected benefit: the office sat directly adjacent to Northrop Grumman's primary Maryland complex. This proximity to Mueller's most long-term client would prove invaluable in fostering the close collaboration and immediate accessibility that had characterized their partnership for years.

A Reunion of Visionaries

The 50th anniversary celebration held at the firm's new office brought together past and present staff, clients, and colleagues, who shared stories of Mueller Associates' impact on the engineering profession. But the evening's most poignant moment came when Richard Mueller and Gene Nerf—the two men whose partnership had defined the firm's first half-century—stood together once again.

Richard Mueller, now 87, had established the firm with a vision of engineering excellence rooted in rigorous standards and unwavering professional integrity. Gene Nerf, who had joined the firm before Mueller's purchase of ENSERCO, had served as protégé, partner, and eventual successor, carrying those founding principles into his own presidency. "I learned something from him on every job," Gene had once said about Richard Mueller. "He was a terrific mentor with high integrity and strong convictions." Mueller, in turn, had recognized in Gene the qualities that would sustain the firm's culture: "It was the professionalism of engineers like Gene that kept clients coming back."



Gene Nerf and Richard Mueller in the 1970s, and reunited at the firm's 50th-anniversary celebration in 2016. Four decades separated the two images, but not the partnership of mentor and protégé that had shaped Mueller Associates from its earliest years.

Seeing these two men together—separated by a generation, but united by shared values and mutual respect—reminded everyone that the success of Mueller Associates had never been about individual brilliance. It had been built upon a foundation of mentorship, in which each generation learned from the one that had come before, absorbed its values, and carried them forward, while also adapting to new challenges. The firm that Richard Mueller founded had grown because he had invested in people like Gene Nerf, who in turn had mentored Bob Marino, who now led a firm poised to take on its most ambitious projects yet.

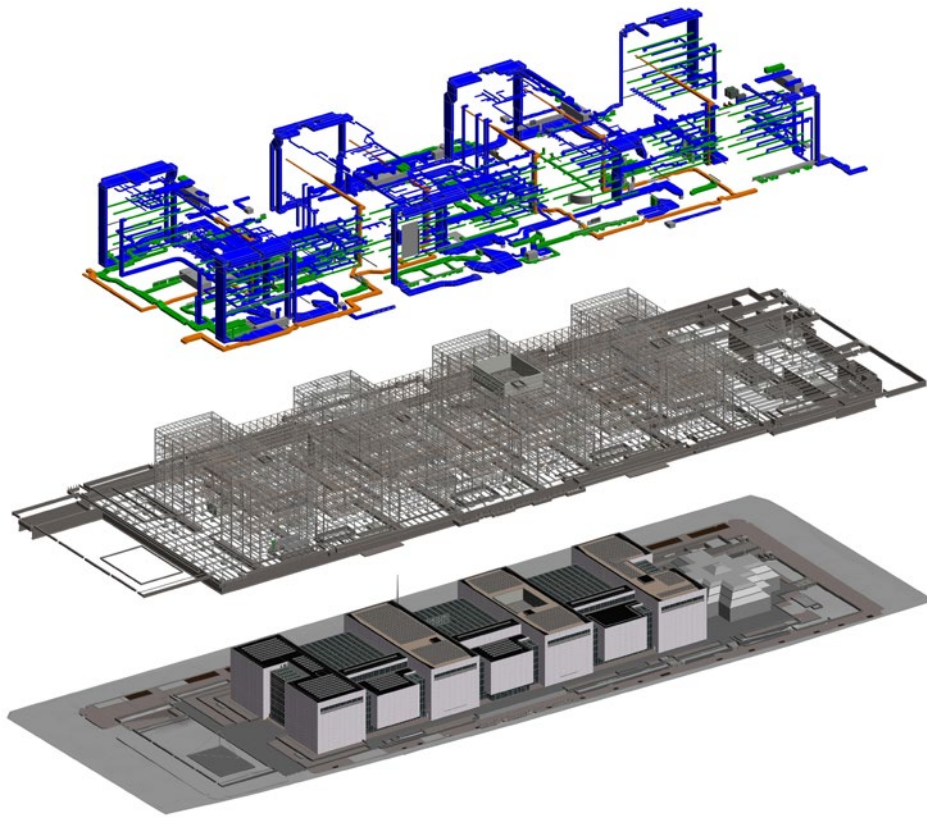
A Convergence of Milestones

The timing of the 50th anniversary proved auspicious. As Mueller Associates settled into its new headquarters and celebrated a half-century in practice, its engineers were already at work on what would become the firm's largest

and most preeminent commission: the comprehensive modernization of the Smithsonian Institution's National Air and Space Museum. This 687,000-square-foot undertaking would span 13 years, and test every skill the firm had developed.

For a company that had completed its first museum project nearly four decades earlier, the National Air and Space Museum commission represented both validation and an extraordinary opportunity. This was not merely a large project; it was the nation's most-visited museum, and an icon of American achievement in aviation and Space exploration.

The timeline carried its own symbolic weight: the project would be completed in 2026, aligning perfectly with both America's 250th anniversary and Mueller's 60th: a convergence of milestones that dovetailed with the firm's role in preserving the nation's cultural and scientific heritage.



An exploded BIM model reveals the layered mechanical, electrical, and plumbing systems threaded through the National Air and Space Museum. As Mueller celebrated its 50th anniversary in 2016, its engineers were finishing the design of this landmark modernization, which had begun in 2013 and was scheduled for completion in 2026.

The project's scale and complexity would require Mueller's engineers to draw upon every lesson learned, every innovation developed, and every relationship built over decades. (A detailed description of Mueller's work on this landmark project is provided in **Chapter 12.**)

As Mueller's engineers celebrated this milestone, they also remained focused on completing the design and construction of several other major capital projects. The Patricia R. Guerrieri Academic Commons at Salisbury University—a 221,000-square-foot reimagining of the University's library into a hub for campus-wide learning and collaboration—opened in August 2016. The Edward St. John Learning & Teaching Center at the University of Maryland, College Park, was nearing completion, and would open in 2017. The Bowie State University Center for Natural Sciences, Mathematics, and Nursing—with its use of chilled-beam

technology—was likewise scheduled to open in 2017. Meanwhile, Duke University's Rubenstein Arts Center, a 71,000-square-foot performing arts building for creative exploration, was advancing toward its January 2018 opening, as was George Washington University's ambitious transformation of a historic museum into the Corcoran School of the Arts & Design. The multi-decade modernization of Baltimore's beloved Enoch Pratt Free Library also moved steadily toward its expected 2019 completion.

The anniversary celebration thus served as both a reflection and a prologue: honoring five decades of achievement, and launching the firm into unprecedented challenges. The new office, the reunion of founding visionaries, and recognition of the firm's ongoing efforts, marked 2016 as another pivotal point in the history of Mueller Associates, with past and present converging to shape future chapters.



A NEW HEART FOR AN ACADEMIC COMMUNITY: THE PATRICIA R. GUERRIERI ACADEMIC COMMONS AT SALISBURY UNIVERSITY

For years, the library at Salisbury University (SU) held the unfortunate distinction of being among the least desirable campus libraries in the country. According to the American Library Association, the existing facility provided less than one-third of the minimum recommended seating for a student body of Salisbury's size, and less than half the necessary space for library materials. Its collections ranked last among the University's performance peers—not because of neglect, but because there was no room to add to the library's holdings. The building that was supposed to serve as the intellectual heart of the campus was, by every measurable standard, failing in its mission.

The solution that University leadership envisioned was something far more ambitious than a bigger, better library. It was a fundamental reimagining of how an entire campus community learns, researches, and collaborates. The result was the **Patricia R. Guerrieri Academic Commons**, named in memory of SU alumna and avid reader Patricia R. Guerrieri. The Commons opened in August 2016, as the largest academic construction project since the University's founding in 1925.

Comprising 221,000 square feet, it is also the tallest building on campus. "This is the most important building

project during my 17-year career at Salisbury University,” said then-President Janet Dudley-Eshbach at the ribbon-cutting ceremony. “The library was intentionally placed in the heart of the main campus, because we see it becoming the epicenter of learning.”

Mueller Associates served as mechanical and plumbing engineer on the project, working within a design-build team led by Gilbane Building Company, with Sasaki Associates as design architect, and Ayers Saint Gross—a firm with deep ties to Mueller—as the architect of record.

Designed Around How People Learn

The building’s organizing principle was as deliberate as it was elegant. Rather than simply aggregating academic programs under one roof, the design team arrayed the building’s programs around a dramatic, light-filled, 62-foot atrium, with each of the four floors dedicated to a distinct mode of learning. The ground floor was devoted to staff-supported, technology-intensive collaboration, housing the main circulation desk, computer and instructional labs, and an around-the-clock study hall. The second floor focused on teaching and learning skills, bringing together academic support programs that had previously been scattered across campus. The Writing Center, Center for Student Achievement, Math Emporium, Faculty Center, Graduate Commons, and the Office of Instructional Design and Delivery are now clustered in close proximity, their shared edges deliberately blurred.

The third floor offered traditional library stacks and reading nooks for quiet, individual study. And the fourth floor, programmed to be as active as the first, housed the 400-seat Assembly Hall, and the **Edward H. Nabb Research Center for Delmarva History and Culture**: a special-collections

library nearly triple its former size, with climate-controlled archival vaults finally worthy of its holdings of irreplaceable manuscripts, maps, artifacts, and records, dating to early explorers and the Colonial era.

The results of consolidation were immediate and measurable. During the first full semester after the Commons opened, the Writing Center reported a 40% increase in student usage; the Center for Student Achievement reported a 20% increase. More than 2,000 study seats, 17 programs and departments, and 14 classrooms now share a single, coherent address at the center of campus.

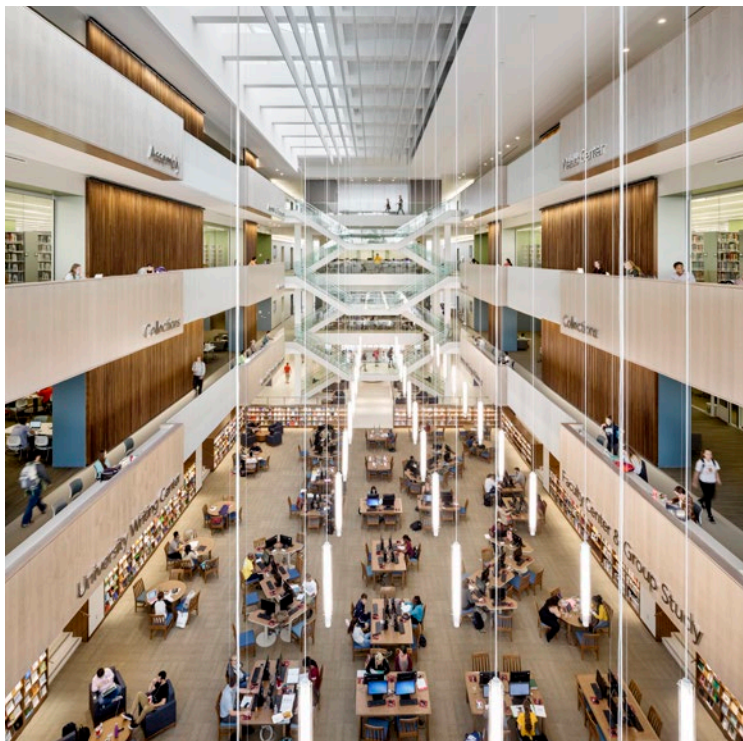
Conditioning Two Buildings in One

For Mueller’s engineers, the Guerrieri Academic Commons presented a challenge that was familiar in its outlines, but demanding in its specifics: a single building with radically disparate environmental requirements on different floors and in different zones. The vast majority of the building—classrooms, study areas, faculty offices, café, assembly hall—required standard comfort conditioning. The Nabb Research Center required something else entirely.

The 20,000-square-foot Nabb Research Center houses primary-source materials of extraordinary cultural significance: manuscript collections, archaeological artifacts, historical maps, and photographic archives documenting the history and culture of the Delmarva Peninsula. These materials demand the kind of precise environmental controls more commonly associated with major museums than university libraries: stable temperature and relative humidity maintained within narrow year-round tolerances, with little margin for fluctuations that could accelerate the deterioration of organic materials.



The Patricia R. Guerrieri Academic Commons (top) opened in 2016 as the new heart of Salisbury University—its tallest building, organized around a 62-foot atrium (bottom left) where four floors each support a distinct mode of learning. On the top floor, the Nabb Research Center (bottom right) safeguards irreplaceable Delmarva-history collections in a museum-grade environment that Mueller’s engineers designed.



Mueller's engineering solutions addressed both worlds simultaneously. The building generates its own chilled and heated water through high-efficiency water-cooled chillers and high-efficiency gas-fired condensing boilers. An air-cooled dedicated heat-recovery chiller supplements the system, generating both chilled and heating water simultaneously: an arrangement that handles the building's cooling and heating conditions in both winter and summer with particular efficiency. For the airside, variable-air-volume (VAV) custom air-handling units, equipped with enthalpy energy-recovery wheels, serve the majority of the building's spaces, capturing energy from exhaust air to precondition incoming outside air, while reducing the building's overall energy demands.

The Nabb Research Center's archival environments required a more specialized approach. Dedicated air-handling units incorporating both humidification capability and desiccant-wheel technology provide the precise temperature and relative humidity controls that conservation demands. This solution removes moisture from incoming air with far greater consistency than conventional cooling-based dehumidification, then conditions the air to exacting setpoints before introducing it into the archive and exhibition spaces. The result is an environment that protects irreplaceable materials not merely today, but across the decades and for generations to come.

Sustainability at Scale

The Guerrieri Academic Commons achieved LEED Gold certification, and its most visible sustainable feature became one of its most distinctive architectural elements: a 20,000-square-foot green roof comprising sedum and other low-growing regional plants. At the time of construction, it was the largest green roof installation within the

University of Maryland system. The roof system absorbs and filters rainwater, significantly reducing runoff into the surrounding stormwater infrastructure. Micro-bioretenion basins installed in the landscape areas around the building complement the roof's stormwater performance, capturing water and returning it to the environment, rather than the municipal system.

The project's builders also recycled 90% of waste generated during construction, well exceeding minimum LEED requirements—reflecting a shared commitment across the design-build team to environmental responsibility at every phase of the project.

For Mueller Associates, the Guerrieri Academic Commons project demonstrated the firm's ability to engineer complex, multi-use academic buildings where environmental precision must coexist with everyday comfort, and where the systems supporting each must remain invisible to the people who depend upon them.

In a building designed to be many things simultaneously—library, archive, classroom, café, performance hall, and gathering space—Mueller's engineering ensures that each function is supported with equal care, enabling the learning that the building was always meant to inspire.



ENGINEERING INNOVATION FOR HIGHER EDUCATION: THE EDWARD ST. JOHN LEARNING & TEACHING CENTER AT THE UNIVERSITY OF MARYLAND, COLLEGE PARK

When the University of Maryland approved plans for a new classroom building in 1987, no one imagined it would take nearly three decades to break ground. But when design finally commenced in July 2012, the **Edward St. John Learning & Teaching Center** represented something far more ambitious than the original vision. It was the first new building dedicated to classroom and laboratory space on the College Park campus in some 50 years, and a response to how students learn in the 21st century.

For Mueller Associates, the project presented an opportunity to demonstrate everything the firm had learned about engineering for higher education buildings. The challenge: create systems sophisticated enough to serve 12,000 students daily, while integrating historic preservation, cutting-edge technology, and sustainable design into a single cohesive vision.

Where History Meets Innovation

The collaboration between Mueller Associates and architect Ayers Saint Gross began with a distinct challenge: integrating the preservation of historic Holzapfel Hall (1930) with a substantial modern addition that would serve as a new campus gateway. The design required demolishing Shriver Hall and a portion of Holzapfel Hall to make way for 160,000 square feet of new construction. The project required a delicate balance between honoring the historic character of McKeldin Mall—a nine-acre area in the heart of campus—and a need to develop the flexible, technology-rich spaces that contemporary learning demands.

What emerged would later be nicknamed “ESJ” by students: a building housing 11 high-tech classrooms, nine chemistry laboratories, seven glass-enclosed “huddle rooms” for collaborative study, and multiple cafés and student lounges. The chemistry facilities alone required specialized support spaces for preparation, equipment, instruments, chemical storage and dispensing, glass washing, and autoclave operations. Each space presented distinct engineering requirements, and all had to function seamlessly within a building designed to adapt to educational needs not yet imagined.

The Hidden Power Plant

Perhaps the most innovative aspect of Mueller’s engineering work lay hidden from the thousands of students who would fill ESJ’s classrooms: the integrated new Satellite Central Utilities Building (SCUB), embedded within the Center itself. The chiller plant features two 500-ton, variable-speed, magnetic-bearing chillers operating with inverted-condenser water temperatures—technology specifically selected to optimize off-peak operating savings and reduce the University’s energy costs.

But Mueller’s engineers envisioned something more ambitious than a standalone utility system. They designed the plant to interconnect with an 800-ton chiller plant in the recently renovated H.J. Patterson Hall—another Mueller project. This integration allows the two plants to operate either independently or in parallel, resulting in a flexible campus-wide system that maximizes energy efficiency. In independent mode, the ESJ plant serves both the Learning Center and neighboring Symons Hall, while the H.J. Patterson plant serves its own building, the adjacent Health Center, and Jimenez Hall. The result is a resilient, adaptable infrastructure that gives the University options as campus needs evolve.

The heating plant, supplied by the campus steam system, incorporates shell-and-tube heat exchangers with a variable-flow distribution system serving pressure-independent control valves throughout the building complex. These technical details matter, because they represent the invisible foundation that makes everything else possible: the climate control that allows students to focus on learning rather than discomfort, the reliability ensuring that laboratory experiments proceed without interruption, and the efficiency that makes sustainability goals achievable.

Engineering the Sustainable Campus

By the time ESJ entered the design phase, sustainability had evolved from an optional feature to a fundamental requirement on institutional projects. Mueller’s engineering designs incorporated air-to-air energy recovery for all central air-handling systems and dedicated outside-air systems, demand-controlled ventilation, high-efficiency variable-speed chillers and controls, and premium-efficiency variable-speed distribution systems for domestic water, and water heating and cooling.



Opened in 2017, the Edward St. John Learning & Teaching Center serves roughly 12,000 students a day across active-learning classrooms, collaborative huddle rooms, and chemistry labs.

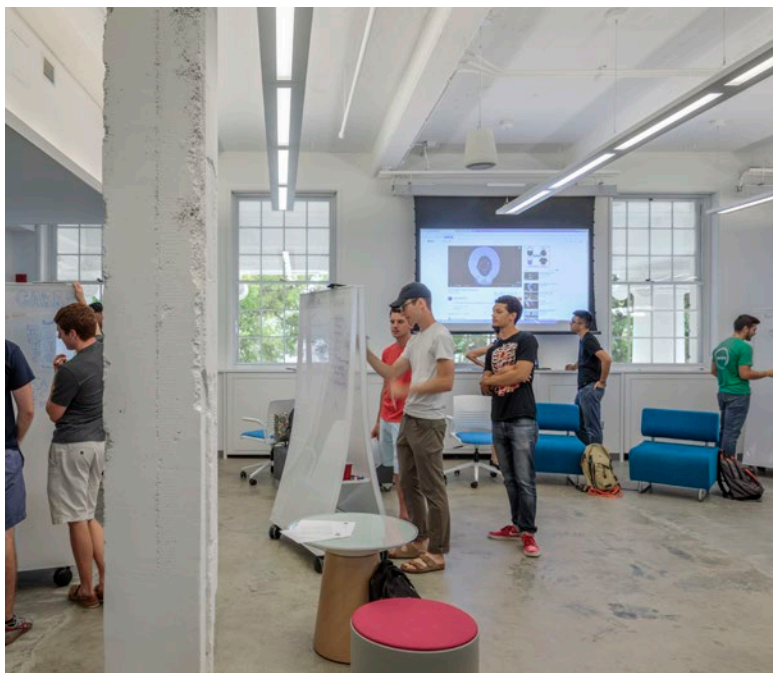
Water conservation received equal attention. High-efficiency plumbing fixtures throughout the building reduce consumption, while recovery systems capture air-conditioning condensate for use as cooling-tower makeup water, thus transforming potential waste into a resource. The design integrates flash steam-heat recovery and high-efficiency light fixtures with occupancy and daylighting controls, all managed by a sophisticated building automation system that features pressure-independent control valves, energy metering, and continuous monitoring to optimize performance.

Mueller's engineers also designed systems to support future enhancements: rainwater harvesting for toilets and urinals, a solar thermal system for domestic hot-water generation, air-quality sensing and controls for laboratory spaces, and

a photovoltaic system. These provisions acknowledge a fundamental truth about institutional buildings: they must be designed not just for opening day, but for adaptation and enhancement over decades of service.

Teaching Through Technology

The ESJ project was distinctive not only for its engineering systems, but also for its educational philosophy. All classrooms were designed to support an active-learning, team-based format called TERP—Teach, Engage, Respond, Participate. The spaces include tiered collaborative areas seating 156 to 334 students, round classrooms accommodating 42 to 132 students, and media-shared spaces for 60 students, all equipped with technology supporting collaborative learning, rather than traditional lecture formats.



This philosophy represented a significant departure from conventional classroom design, requiring Mueller's engineers to rethink how building systems support learning. The technology infrastructure had to be robust enough for intensive daily use, and flexible enough to accommodate technologies yet to be invented. Climate control had to maintain comfort in spaces where student density and activity levels vary dramatically throughout the day. Lighting had to support both traditional instruction and technology-enhanced collaboration.

Beyond classrooms and laboratories, ESJ houses three units dedicated to supporting teaching, learning, and innovation: the Teaching and Learning Transformation Center, providing faculty, students, and staff with training and resources; the Academy of Innovation and Entrepreneurship, cultivating what the University calls "fearless innovators"; and the Division of IT: Academic Technology & Innovation, supporting technology-related research and deployment across campus. Each required distinct engineering solutions, while contributing to the building's overall mission.



In the active-learning classrooms (top), students work in teams; in the building's chemistry labs (bottom), precise ventilation make hands-on experimentation possible.

The Edward St. John Learning & Teaching Center opened in 2017, fulfilling a vision three decades in the making. For Mueller Associates, it demonstrated the firm's ability to engineer complex systems that support the evolving needs of higher education: balancing historic preservation with cutting-edge technology, energy efficiency with occupant comfort, and current requirements with future adaptability. In a building serving thousands of students daily, Mueller's engineering remains characteristically invisible, enabling rather than announcing itself, while also supporting the University's mission of teaching and discovery.



PIONEERING SUSTAINABLE ENGINEERING: BOWIE STATE UNIVERSITY'S CENTER FOR NATURAL SCIENCES, MATHEMATICS, AND NURSING

When Mueller Associates partnered with the internationally recognized architecture firm Perkins&Will on Bowie State University's **Center for Natural Sciences, Mathematics, and Nursing**, the collaboration sparked innovation that challenged conventional thinking on laboratory climate control. Founded in 1865, Bowie State University (BSU) is Maryland's oldest Historically Black College and University (HBCU), and this new facility represented a significant investment in the institution's future. Completed in 2017, the 149,000-square-foot facility houses teaching laboratories, nursing-simulation suites, classrooms, a 130-person lecture hall, and a fully equipped research greenhouse. But

it is the building's engineering systems—particularly its unconventional cooling approach—that distinguish it as a showcase for sustainable design.

The building emerged from the University System of Maryland's strategic commitment to STEM education. For Mueller's engineering team, the challenge extended beyond creating optimal environments for these diverse academic functions: they needed to achieve LEED Platinum certification, while demonstrating that innovative sustainable systems could deliver both superior performance and economic value.

Rethinking Laboratory Climate Control

The heart of Mueller's engineering innovation lay in a technology still relatively uncommon in American buildings: an active chilled-beam system. Mueller's engineering team recognized that laboratory spaces—which often house heat-generating equipment—provide an ideal environment for chilled-beam technology: a system with unique characteristics that could deliver maximum benefit.

The conventional approach to laboratory cooling relies upon massive air-handling units and extensive ductwork, in order to supply enough conditioned air to offset heat from equipment, lighting, and occupants. Mueller's team suggested something different. The proposed chilled-beam system uses low-dewpoint primary air for ventilation, dehumidification, and pressurization, distributed through ceiling-mounted beams, with nozzles that accelerate the air and induce room air across chilled-water cooling coils. This approach decouples ventilation from sensible cooling: the primary air handles dehumidification and fresh-air requirements, while the chilled beams meet local cooling loads by recirculating room air.

The implications were significant. Because the central air-handling unit no longer needed capacity to meet the sensible load for the entire space—typically the largest portion of laboratory cooling requirements—both the equipment and ductwork could be dramatically smaller than conventional systems. For the University, this translated into immediate construction savings: the reduced ductwork enabled the design team to lower the second and third floors by one foot each. These savings effectively offset the higher first cost of the chilled-beam system, while reducing long-term operating expenses through lower energy consumption.

Beyond the Beams

Mueller's engineering innovations extended throughout the building's systems. The team designed a multi-parameter demand-controlled ventilation system that continuously samples laboratory air for carbon dioxide, carbon monoxide, total volatile organic compounds, and airborne particulates. Rather than running at maximum capacity continuously, the system increases airflow only when measured parameters reach their maximum. When air quality permits, the system maintains minimum safe ventilation rates, yielding substantial energy savings without compromising safety or comfort.

The building's façade presented another engineering challenge. Approximately 25,000 square feet of dynamic glazing—smart glass that automatically transitions from clear, to tinted, to nearly opaque based on weather conditions and time of day—would significantly affect the building's thermal performance throughout the day. Mueller's engineers incorporated shading-coefficient ranges into their energy simulations, ensuring that mechanical systems would operate efficiently, regardless of the façade's changing properties.

Growing Under Glass

The third-floor research and teaching greenhouse required specialized environmental controls. Mueller combined automated vents, exhaust fans, and evaporative cooling pads, while hydronic unit heaters supplied heat through the building's hot-water system. Motorized shades respond to schedules, temperature, and crop-lighting needs based on solar radiation. Temperature and humidity sensors support continuous monitoring and data collection, with adjustable alarms warning of conditions that could threaten plant research.



Two of the building's defining systems. In the labs (top left and bottom left), an active chilled-beam system cools these heat-heavy spaces while shrinking ductwork and floor-to-floor heights. In the daylit atrium (right), roughly 25,000 square feet of dynamic "smart glass" tints automatically to control solar heat and glare without sacrificing the view.

These greenhouse systems had to operate reliably year round, supporting both instructional programs and ongoing research: a reminder that building systems must serve not only occupant comfort, but also the specific missions they support. A failed greenhouse climate system does not just create discomfort; it can destroy months of research and compromise educational programs.

Infrastructure for the Future

Mueller's electrical engineering design provided the robust, flexible infrastructure essential for a modern science building. The team designed a single-ended unit substation with 3000kVA capacity at 480Y/277V secondary voltage and 4000A main, with service derived from the campus' existing 13.2kV dual-radial system. Bus ducts, routed vertically through two sets of stacked electrical closets, provide distribution with built-in flexibility for future modifications—an acknowledgment that today's cutting-edge laboratory equipment will inevitably give way to future technologies.

Each laboratory was given dedicated panelboards for isolation and control. A 550kW natural-gas-fired engine generator set on the roof supplies the fire pump, life-safety loads, IT systems, and critical laboratory and HVAC loads, ensuring that power interruptions do not compromise safety, or interrupt time-sensitive research.

Energy efficiency shaped every electrical-design decision. Extensive metering provides continuous feedback to the university to monitor loads, and optimize equipment use. Variable-frequency drives control motors throughout the building, modulating power consumption to match actual demand. All lighting fixtures use LED sources, with controls including dimming, vacancy and occupancy sensing, daylight harvesting, and time-of-day scheduling. These systems

work together to minimize energy waste, while maintaining the illumination required by laboratories and classrooms.

Coordination Through Technology

BIM proved crucial in coordinating the project's complexity. The technology enabled Mueller's team to visualize equipment and piping layouts in 3D, optimizing the use of mechanical equipment rooms before construction began. The isometric-style drawings generated using the BIM model proved so valuable that they were included in the bid sets, giving contractors unprecedented clarity about the systems they would be installing. Clash-detection tests identified areas requiring intensive coordination, allowing the team to resolve potential conflicts in the digital model, rather than discovering them during construction.

BSU's Center for Natural Sciences, Mathematics, and Nursing opened in 2017. It earned LEED Platinum certification, demonstrating that innovative sustainable systems can deliver superior performance and economic value.

For Mueller Associates, the project established a successful foundation for future collaborations with Perkins&Will, and proved that chilled-beam technology—still uncommon in American laboratories—could transform how science buildings are engineered. While the building serves STEM programs at BSU, it also demonstrates that sustainability and performance need not compete, but can advance together through thoughtful engineering.



ENGINEERING FOR “ART IN ACTION”: THE RUBENSTEIN ARTS CENTER AT DUKE UNIVERSITY

When David M. Rubenstein, chairman of Duke University’s Board of Trustees, contributed \$25 million toward a new arts center on the Durham campus, he articulated a vision that would shape everything that followed: the arts should become “an essential part of every Duke student’s experience.” The University had spent a decade building toward that vision, opening the Nasher Museum of Art in 2005, and transforming Baldwin Auditorium into a concert hall in 2015. What remained was a great place to make art—a building where students, faculty, and artists-in-residence could work in dedicated, professionally equipped spaces, rather than adapting to whatever happened to be available.

The **Rubenstein Arts Center**, designed by William Rawn Associates and completed in January 2018, answered that need. Known as “the Ruby,” the 71,000-square-foot facility was conceived not as a collection of departmental spaces, but as a laboratory for creative exploration—deliberately non-curricular, deliberately flexible, and deliberately visible. The building’s paneled glass façade was not merely an aesthetic choice; it was a statement of intent. Art-making at the Ruby would be on display at all times, animating the campus with views of rehearsals, installations, and production activity, while also serving as a standing invitation for anyone passing by to stop in and make something of their own.

Studios and the Challenge of Flexibility

At the heart of the Ruby's design were 12 flexible studio modules, arranged around a central commons and outdoor working yard. Each studio was deliberately non-departmental and broadly equipped, designed so that different programs could shift venues, share spaces, or collaborate without impediment. No single department controlled access: a decision that originated in the provost's office and reflected Duke's institutional commitment to cross-disciplinary work. The result was a building free to be experimental—one that could serve a dance rehearsal in the morning, a filmmaking workshop in the afternoon, and a multimedia installation in the evening.

This radical flexibility was the building's greatest asset—and, for Mueller's engineers, its defining engineering challenge. "The hallmark of the Ruby is its flexibility," said Tom Syvertsen, Mueller's project manager and lead mechanical engineer. "There are many different uses and types of spaces, from the glass-enclosed dance cube, which features radiant heat for the dancers' comfort, to the visual arts studios that require special ventilation."

The range of spaces and their demands was remarkable in its variety. The 200-seat black-box theater for performance and media arts projects required theatrical lighting loads and variable-occupancy conditioning. The 100-seat film theater, equipped for digital cinema alongside 35mm and 16mm archival projection, required acoustical isolation and precise light control. Dance rehearsal studios, including the building's signature glass-enclosed dance cube on the second floor—exposed to the campus on multiple sides—required radiant heating systems that would maintain warmth for dancers and combat drafts from the expansive glazing without added noise from the forced-air systems.

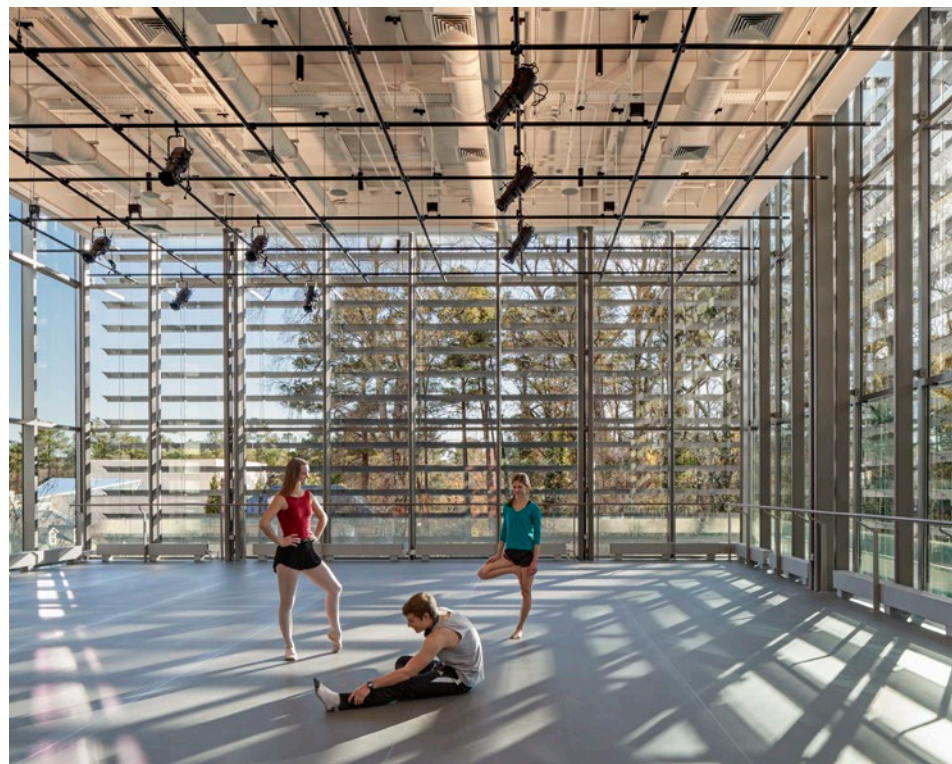
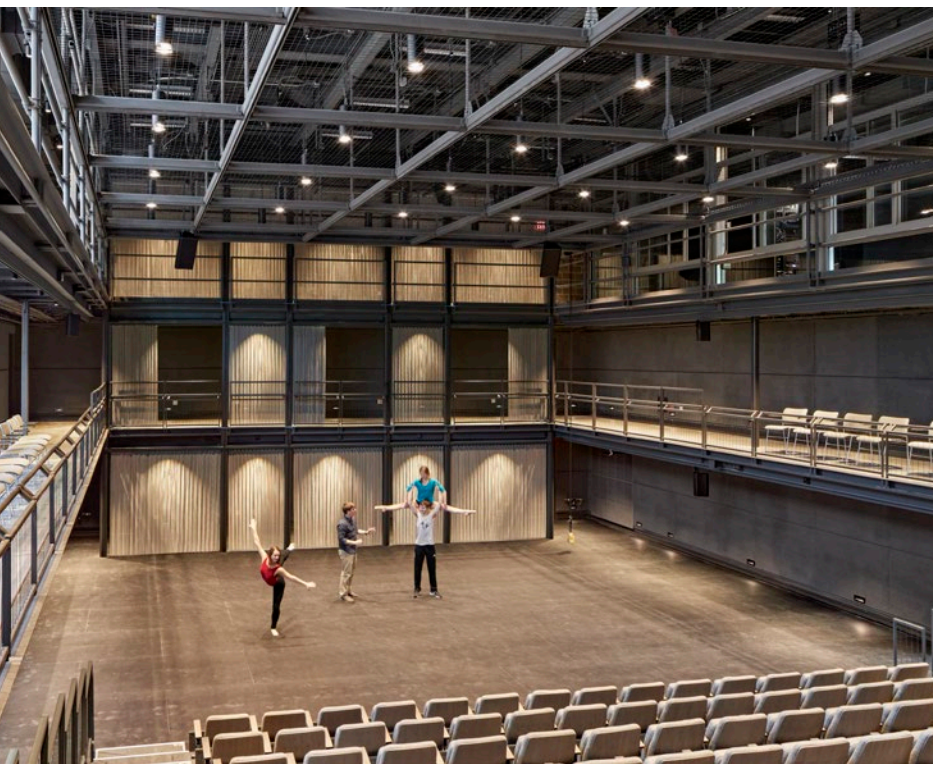
Video-production studios for the Arts of the Moving Image program and the Center for Documentary Studies required dedicated ventilation. Painting and drawing studios required exhaust systems appropriate for art materials. The WXDU student radio station required acoustical isolation from the building's most active spaces.

Acoustics as Engineering

Perhaps no single challenge shaped Mueller's engineering decisions across the Ruby more consistently than acoustics. A building that places a 200-seat theater, dance studios, production facilities, a radio station, and open collaborative lounges in close proximity—then wraps much of it in glass—creates acoustical complexity that must be resolved in the engineering, not merely addressed after the fact.

Mueller's approach began with duct sizing. Acoustical performance in HVAC systems depends significantly upon air velocity: generously sized ductwork reduces the turbulence and noise that HVAC systems introduce into sensitive spaces. Mueller specified duct sizes throughout the building with acoustical performance as a primary criterion, then incorporated acoustical lining within the ductwork and sound attenuators—silencers—strategically positioned to interrupt sound transmission through the duct system before it could migrate between spaces. "The adjacencies and stringent acoustical requirements of the various spaces added some complexity to the project," Syvertsen noted.

The HVAC system was also designed to accommodate the elevated thermal loads that major productions generate. Theatrical lighting, film projection equipment, large audiences, and active performers all contribute heat gains that a system sized for normal occupancy could not reliably manage.



Flexibility is the Ruby's hallmark, and Mueller's engineering was designed to support it—from the Ruby Lounge (left), where an overhead pipe grid allows the space to be rigged and re-rigged for a variety of productions, to the glass-enclosed Dance Cube (right), where radiant heating maintains dancers' comfort and offsets drafts from the expansive glazing without adding noise from forced-air systems.

Ruby Lounge and Other Infrastructure

The “Ruby Lounge”—the building’s multipurpose student performance and event space—illustrated the integration of engineering and architectural intent. Overhead pipe grids installed at ceiling level provide adaptable infrastructure for theatrical lighting and production equipment, allowing the space to be rigged and re-rigged for different configurations, without permanent installation. The mechanical and electrical systems supporting the lounge were coordinated to work with, rather than around, this production infrastructure: the ceiling grid determines where equipment

lives; Mueller’s systems were designed to accommodate whatever the grid might hold.

The Rubenstein Arts Center celebrated its grand opening in January 2018. For Mueller Associates, the Ruby represented something the firm understood deeply from its decades of work in cultural and performing arts facilities: that the best engineering in a building devoted to creativity is the engineering that never intrudes upon it. Instead, it quietly accommodates every configuration, every production, every discipline, while the art being made remains the only thing the audience notices.



ENGINEERING SUCCESS WITHIN A HISTORIC LANDMARK: THE CORCORAN SCHOOL OF THE ARTS & DESIGN AT GEORGE WASHINGTON UNIVERSITY

Just two blocks from the White House stands one of Washington's most distinguished Beaux-Arts buildings, a structure whose classical façade has overlooked 17th Street since 1897.

Designed by Ernest Flagg for banker and philanthropist William Wilson Corcoran, the building was conceived on an ambitious scale: it would house both an expanding art collection and the Corcoran School of Art, which had been officially founded in 1890. The Corcoran had already outgrown his original gallery—designed by James Renwick at Pennsylvania Avenue and 17th Street, now the Smithsonian's Renwick Gallery—within a few decades of its 1869 opening. The new building, inscribed with its founder's mission to be

“dedicated to art and used solely for the purpose of encouraging the American genius,” was the first institution in the United States created specifically as an art museum.

The 135,000-square-foot structure embodied the grandeur of its era. Flagg's design featured a dramatic central atrium with soaring ceilings. Its elegant galleries were lit by an ingenious natural daylighting system of roof skylights and “lay-lights,” which channeled illumination into exhibition spaces below, and Classical details featured throughout the building. In 1928, the collection expanded significantly when Senator William A. Clark's extensive European art holdings found a home in a new wing designed by Charles Adam Platt, seamlessly integrated into Flagg's original vision.

“Save the Corcoran”

For more than a century, the Corcoran thrived as one of Washington’s leading cultural institutions. By the early 21st century, however, financial pressures were mounting. The Gallery’s operating budget depended upon grants, admissions, tuition from the art school, membership dues, and an endowment. It was a precarious foundation compared to the federally funded Smithsonian museums and National Gallery of Art (NGA), both of which offered free admission, while the Corcoran charged ten dollars. Fundraising plummeted from \$13 million in 2007 to just \$3.2 million in 2012. Meanwhile, the historic building required up to \$130 million for deferred maintenance and renovations.

In 2014, a lawsuit filed by the organization “Save the Corcoran” led to a court-ordered dissolution. The NGA received more 8,600 works from the Corcoran’s 17,000-item collection. George Washington University acquired the historic building, along with a \$50-million endowment to renovate the facility. The University also committed itself to preserving the Corcoran’s original mission, while transforming the structure into a modern home for what would become the **Corcoran School of the Arts & Design**.

The challenge was formidable. Listed on the National Register of Historic Places, and protected by local preservation rules, the 120-year-old building would require extreme care in its transformation. For Mueller Associates, the project would demand engineering solutions unlike anything the firm had attempted before.

Discovering What Exists

The engineering challenges began with a fundamental problem: minimal documentation of the existing building.

Original drawings were scarce, and 120 years of modifications—some documented, many not—had left the structure’s systems a mystery.

The design team, led by LEO A DALY, employed advanced investigative techniques to understand what they were working with. Laser scanning captured the building’s exact geometry. Ground-penetrating radar revealed what lay beneath floor slabs. Hygrothermal wall analysis helped them understand moisture behavior in the historical masonry. Computational fluid-dynamics modeling predicted airflow through complex spaces. CCTV pipe-camera surveys assessed the condition and routing of existing plumbing: essential information when it came to adding new toilet fixtures throughout the facility.

These investigations revealed surprising conditions. The building featured uncommon Metropolitan-slab floors made of gypsum and wood chips, reinforced with piano wire. Stone columns in the main atrium rested on cast-iron columns in the basement—elegant on the upper floors, practical below. Understanding these conditions allowed Mueller’s engineers to work with the building’s realities, rather than making assumptions that could prove disastrous during construction.

The Swiss-Watch Solution

Mueller’s engineers faced a puzzle that seemed impossible to solve. The building needed entirely new mechanical systems to meet modern environmental standards and support 21st-century art education. The NGA, which would occupy portions of the second floor, required stringent temperature and humidity controls within narrow year-round ranges: museum-grade precision with no margin for error. The University’s program included specialized HVAC

requirements for various laboratory and classroom spaces. Yet the building offered virtually no space for the equipment necessary to achieve these conditions.

The existing natural daylighting system—Flagg’s elegant arrangement of roof skylights and laylights—severely constrained where new mechanical equipment could be installed. “We were spatially challenged because of the historic nature of the building,” said Steven Gillis, principal and project manager with Mueller. “There was minimal space for MEP systems.” Attic spaces—the traditional location for air-handling equipment in older buildings—could accommodate nothing that would block natural daylight into the galleries, or that would create shadows affecting the viewing of art in exhibition areas. A sightline easement held by a neighboring building prohibited the installation of large mechanical penthouses on the roof: a solution that would have simplified everything.

Working closely with the architecture team at LEO A DALY, Mueller’s engineers developed a solution the firm had never attempted on any previous project. The team would fill a three-story courtyard near the building’s core with a multi-level equipment platform that Gillis compared to “a big Swiss watch.”

The platform’s complexity reflected the intricate choreography required to serve the building’s diverse needs. At ground level, it accommodates a variable refrigerant-flow system with heat recovery, serving the basement shop and academic spaces, plus dust-collection units for the metal and wood shops in the sub-basement. The first level houses three air-handling units, with exhaust-air energy recovery serving basement areas, while conditioning the sub-basement shop spaces. A large variable-air-volume type of

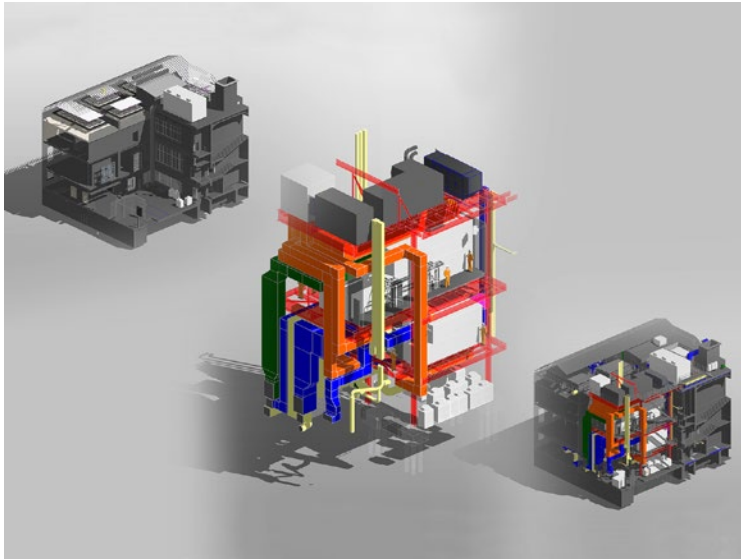
air-handling unit, with exhaust-air energy recovery at the second level, serves first-floor academic spaces and the iconic atrium. A gas-fired emergency generator is located on the platform’s roof level.

This vertical arrangement solved multiple problems simultaneously. It placed equipment where the building could structurally accommodate it. It kept machinery accessible for maintenance, while remaining invisible to building occupants. It provided the capacity and precision necessary to meet NGA standards, while serving the University’s varied programming needs. The solution required custom engineering for nearly every component: there were no off-the-shelf answers for threading modern building systems through a Beaux-Arts masterpiece, while also preserving everything that made the building significant.

Museum-Grade Precision

Designing systems for the second-floor NGA spaces presented its own challenges. The building’s original exterior walls lacked insulation—a typical condition in 1897, but problematic for maintaining museum-grade environmental control. Mueller’s team used computational fluid-dynamics modeling to develop mechanical solutions that met the required conditions within these constraints, carefully positioning equipment and routing ductwork to work with, rather than against, the building’s thermal characteristics.

This requirement was unforgiving. Deviations in temperature and humidity that would go unnoticed in typical office environments could damage priceless works of art, and compromise conservation efforts. Mueller’s systems had to maintain stability—not just during steady-state operation, but through the daily and seasonal cycles that challenge any



With almost no room for mechanical systems inside the Corcoran, Mueller engineered a multi-level equipment platform into a three-story interior courtyard—what Steven Gillis likened to “a big Swiss watch.” The Revit model (top) shows its tightly stacked systems; the rooftop view (bottom), with the Washington Monument beyond, shows the realization.

building, especially one with single-wythe masonry walls and large expanses of historical glazing.

Power and Patience

Modernization of the electrical system required its own careful strategy. “To install new power in the building, we placed a new switchboard adjacent to the existing switchboard in the sub-basement,” recalled Adam Fry, vice president and electrical engineer with Mueller. “The electrical service-entrance conductors were removed, and new ones extended to the new switchboard. During renovation, the distribution switchboards, panelboards, feeds, and branch circuits were removed and replaced. Two electrical closets and generator-supplied emergency-standby loads were created on each floor.”

As portions of the building were renovated, and new power-distribution systems installed, the existing switchboard was eventually removed: a gradual transition that maintained power throughout construction, while completely replacing the building’s electrical infrastructure.

Engineering During Occupation

What made the Corcoran project complex was a requirement that shaped every decision: the art school had to remain operational throughout construction. From the project’s inception, the University communicated the need to maintain functional programs during renovation—no simple matter when replacing every major building system, while preserving the historical fabric and meeting modern codes.

The design team, working collaboratively, developed a phased approach that allowed essential arts programs to operate while other spaces underwent construction. The outcome

was a clear scope of work, broken down into six distinct phases with intricate sub-phasing. The sub-basement, which houses studio spaces for noisy activities such as carpentry and metal sculpture, was renovated during the fifth phase. One floor above—the basement level with studios for painting, printmaking, bookmaking, etching, lithography, book arts, plus a fabrication lab and sculpture studio—was completed during the same phase. The first floor—including the iconic atrium gallery, auditorium, classrooms, and offices—was renovated almost entirely during the third phase. The second floor—housing classrooms, the rotunda, and areas dedicated to the NGA—was completed during the second and sixth phases. The courtyard equipment platform was constructed sequentially during the third, fourth, and fifth phases: a logistical challenge that required the coordination of equipment installation, structural work, and building occupancy across multiple years.

The Invisible Achievement

The renovated Corcoran School of the Arts & Design opened in 2018, transformed into a state-of-the-art facility for arts education, while preserving the historic character that makes the building significant. For visitors, the experience is seamless: galleries bathed in natural light from Flagg’s skylights and laylights, comfortable temperatures year round, studios equipped with modern systems for dust collection and ventilation, spaces that feel simultaneously historic and contemporary.

Mueller’s intricate engineering work remains characteristically invisible. The multi-level equipment platform tucked into the courtyard, the precisely routed ductwork threading through attic spaces without blocking sightlines, the electrical and plumbing systems woven through the building’s



To preserve Ernest Flagg’s original daylighting, Mueller threaded new ductwork and piping through the building’s cramped attic, careful that nothing would cast a shadow through the laylights. The resulting light pours into the renovated classrooms below.

historical fabric without damaging it—these achievements announce themselves only in their absence of problems. The building simply works, supporting its mission of being “Dedicated to Art” as its founder intended—now equipped to serve that purpose for generations to come.

For Mueller, the Corcoran project demonstrated the firm’s ability to solve seemingly impossible engineering problems, while respecting the constraints of historic preservation and creating functional environments for 21st-century use. It was engineering at its most creative: finding solutions where none seemed to exist, making the impossible merely difficult, and doing it all while keeping an art school running.



PRESERVING BALTIMORE'S LITERARY LEGACY: THE ENOCH PRATT FREE LIBRARY

In 1882, Baltimore banker and philanthropist Enoch Pratt made an extraordinary offer to the city: he would establish a free public library and endow it with \$1 million—an immense sum at the time—on one condition: the library must be truly public, genuinely free, and open to all. “My library shall be for all, rich and poor without distinction of race or color,” he declared. It was a radical statement during an era in which public institutions routinely practiced discrimination (Baltimore became a segregated city in the 1910s), and charged fees for access.

Pratt had accumulated his fortune through careful banking and real estate investments, but he also understood something fundamental about the relationship between

knowledge and democracy. Born in Massachusetts in 1808, he had moved to Baltimore in 1831, and built one of the city’s most successful financial institutions. Yet his greatest legacy would not be the money he made, but what he chose to do with it. The **Enoch Pratt Free Library** opened in 1886, establishing a model that would influence the development of public libraries across America: a central library with branches throughout the city, offering free access to books, information, and opportunity.

A Library for Hard Times

The first Enoch Pratt Free Library building served Baltimore for nearly half a century before outgrowing its capacity. In

1931, as the nation further descended into the depths of the Great Depression, the old structure was demolished to make way for a new library designed by Baltimore architects Clyde and Nelson Friz. The firm worked with consulting architects Edward Tilton and Alfred Morton Githens of New York, who specialized in library design. The timing seemed almost perverse: constructing a grand public building while unemployment soared and private construction had virtually ceased. Yet the Library's Director, Joseph Wheeler, understood that hard times made public libraries more essential, not less.

Wheeler brought a revolutionary vision to the project. He rejected the traditional approach of building libraries with monumental entrances atop long, intimidating flights of stairs. To him, this imposing Classical style suggested that libraries were temples for the initiated, rather than resources for the public. Instead, Wheeler envisioned what he called a publicly owned "department store for knowledge." The entrance and monumental windows for the new Pratt would be placed at street level, and decorated with eye-catching displays. The building would be welcoming, accessible, democratic—everything Enoch Pratt had intended.

The limestone-clad structure that opened in February 1933 embodied Art Deco elegance with stylized Classical motifs. At its heart stood the multi-story Central Hall, flooded with natural light, housing the circulation desk and, for decades, rows upon rows of card catalogs—the search engine of its era. The building also featured the Maryland Room: a specialized space for Baltimore and state historic materials that would become an essential resource for researchers, genealogists, and anyone seeking to explore the area's past.

The new Library represented more than an architectural achievement. Opening in the midst of the Great Depression,

it provided employment during construction, offered free access to information for job seekers, and created a space in which economic hardship did not bar entry. The building fulfilled Pratt's vision, while aligning with Wheeler's view that a library should serve as both practical resource and community anchor.

The Infrastructure Below

With nearly 300,000 square feet spread out across seven levels, the Pratt serves as both the flagship of Baltimore's library system and the designated Maryland State Library Resource Center, welcoming more than two million visitors annually. "This was the Internet before the Internet existed," said Charles Swope, chief mechanical engineer with Mueller. It was about more than lending books. If someone needed a phone number or information, they could call the Central Library, and staff could provide business numbers and a wide range of information. The Library also served as a resource center, distributing books throughout the system, hosting theatrical performances in its third-floor auditorium, and providing space for community programs.

Yet the building's true scope extends far beyond what visitors see upon entering. Below the main floor lie three additional levels of stacks and a sub-basement: an architectural iceberg housing the infrastructure that makes this cultural center possible. Beyond its open-stack areas and reading rooms, a substantial portion of the building houses a central book repository accessed through an intricate system of seven elevators and eight dumbwaiters—a mechanical marvel from an earlier era that presented unique challenges during the renovation.

Building the Foundation: The Annex

By the late 1990s, the Library’s administrators had recognized that this massive structure required comprehensive modernization to meet the technological demands of a 21st-century library, while preserving its historic character. Budget constraints, and the need to keep the Library operational throughout construction, necessitated a strategic approach. This led to a multiphase renovation plan that would ultimately span more than 15 years.

During the first phase, Mueller Associates partnered with Ayers Saint Gross to design a 50,000-square-foot, four-story addition known as the Annex. This structure, connected to the Central Library and completed in 2003, would house some of the institution’s most treasured and sensitive collections: the African-American Collection, the Maryland Collection, the H.L. Mencken Collection, Special Collections, and Rare Books. Its engineering complexity was heightened by the need to build above the Library for the Blind and Physically Handicapped, which remained operational throughout construction.

The collections destined for the Annex required extraordinary care. The H.L. Mencken Collection, for instance, includes the personal library and documents of the famed Baltimore journalist and essayist—the self-described “Sage of Baltimore”—who had bequeathed his papers to the Pratt. The African-American Collection represents decades of collecting materials documenting the Black experience in Baltimore and beyond. The Maryland Collection contains maps, photographs, genealogical records, and historic materials essential for understanding the state’s development. These weren’t merely books to be shelved; they were irreplaceable cultural artifacts requiring precise environmental controls and security.

The Annex houses primarily behind-the-scenes spaces: a data center, book storage, offices, and support areas that would prove crucial to maintaining operations during the more ambitious second phase. This initial phase, however, established not only the physical infrastructure needed for the renovation ahead, but also the collaborative relationships and understanding of the building’s complexities that would prove invaluable in the years to come.

The Main Event: The Historic Building

The project’s most ambitious phase commenced in 2014, focusing on the 1933 building. Design work had begun years earlier. Swope recalled attending his first design meeting for this phase in 2009, when the architect asked, “Well, what did we do in 1998?” His response captured the project’s extraordinary timeline: “I was in high school.” Working alongside Beyer Blinder Belle as design architect, and Ayers Saint Gross as the architect of record, Mueller’s engineers faced the formidable task of designing entirely new building systems for a facility with limited as-built documentation.

“We had very few original drawings to work from,” said Darren Anderson, Mueller’s project manager. “This required us to essentially rediscover the building’s infrastructure through a combination of modern technology and detective work.” Mueller’s engineers created a detailed three-dimensional Revit model using point-cloud laser scanning, which captured the building’s complex geometry with extreme precision. This digital model was verified through extensive field surveys, and supplemented with specialized investigations—including orthoscopic wall probes, selective demolition, and historical documents—to determine the location and characteristics of concealed infrastructure, and to test concealed distribution locations and conditions.

Engineering Within History's Constraints

Designed to attain LEED Silver certification, the renovation posed a complex challenge for Mueller's team: how to replace all existing HVAC and electrical equipment—including outdated chillers and cooling towers that had been unused for years—while safeguarding the building's historical interiors. These included decorative plaster, detailed millwork, ornate ceilings, and unique finishes.

The core challenge, however, was ensuring that the Library continued to serve the community. "The critical feature of our design was making sure the Pratt remained operational throughout construction," said Swope. The team had initially planned nine separate phases, but streamlined the process through close collaboration with the contractor, Gilbane Building Company. An upper- and lower-level renovation approach was ultimately chosen, in order to reduce construction time while keeping library services fully available.

The building's mechanical configuration—with air handlers in both the sub-basement and the penthouse—proved advantageous to a phased approach. The sub-basement systems served the below-grade and main-level book stacks, while penthouse equipment handled the upper floors. This natural division allowed Mueller's engineers to renovate one zone, while the other remained operational.

Yet maintaining services required creative thinking about the use of the space during construction. Large conference areas, and the former telephone-service area on the second and third floors, were temporarily converted into lending services, community outreach programs, and spaces for teens' and children's services. "The programs could never stop," Swope recalled. "We had to serve the community as intended throughout the entire construction process."

Mueller's approach demanded careful attention to ventilation and energy recovery. With more people occupying interim spaces than initially intended, energy consumption could have increased dramatically. "Ventilation was critical because of occupancy levels, which meant substantial energy use," Swope noted. "We implemented strategies to recover this energy because, ultimately, we wanted to make the building better than it was before."

The Art of Invisibility

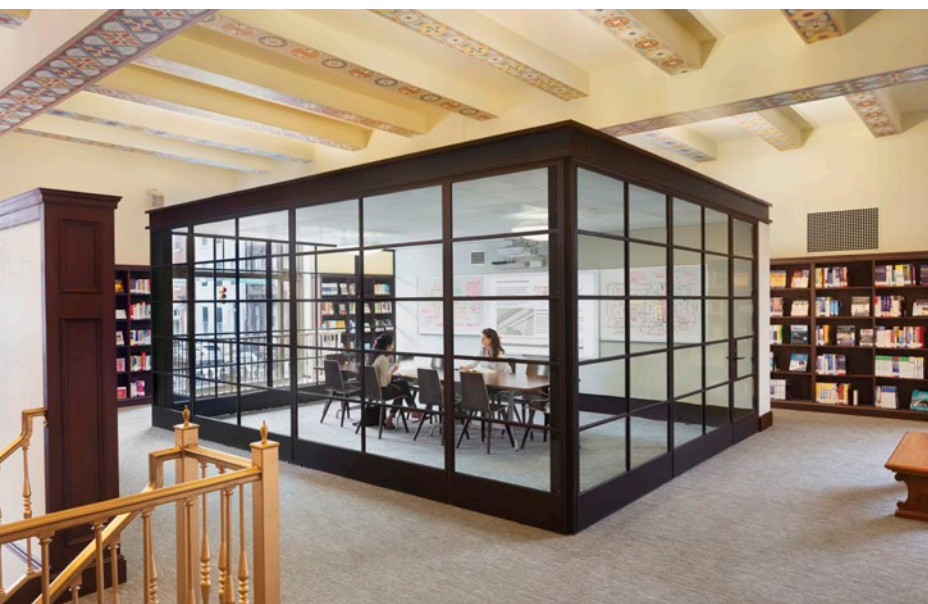
Mueller's solutions required both technical innovation and precise coordination. New ductwork had to be threaded through the building, finding pathways that would not disturb historical features, while still delivering effective climate control throughout the large structure. The 1950s-era fluorescent and incandescent lighting was replaced with restored or replicated historical fixtures, upgraded with energy-efficient LEDs. This helped to preserve the building's aesthetics, while significantly reducing energy use.

"First and foremost, the systems are invisible," said Swope. "If we've done our job well, visitors don't know we've done anything at all. There are some indicators—an air device here, perhaps a sensor on the wall—but this is largely a concealed system."

The challenge of making modern systems invisible within historical fabric required extraordinary precision. Walls were removed, new ductwork and air devices were installed, then everything was carefully reassembled, appearing as though nothing had been touched. "It was challenging to install new equipment, route ductwork and wiring, and integrate fire-protection sprinklers within this historic building," noted Anderson. "It's a grand space, but our opportunities to integrate new systems into existing walls, floors, and ceilings



The renovated Central Hall remains the Pratt's signature space—ornate ceilings, marble columns, and daylight intact, now doubling as a flexible event venue. The systems keeping it comfortable stay out of sight.



Restored reading rooms pair ornate painted ceilings with period light fixtures, replicated and fitted with energy-saving LEDs (right), while a new glass-walled study room (left) tucks contemporary collaboration into the Pratt's historic fabric. The systems behind it all stay out of sight, keeping the Pratt a working library for all of Baltimore.

were very limited. The amount of work we invested in initial analysis and the 3D model paid dividends. The installation proceeded largely as designed. The issues we encountered during construction were minimal.”

A System That Thinks

The renovation featured a state-of-the-art BAS and sophisticated lighting controls, including daylight harvesting and occupancy sensors. These design strategies were estimated to reduce energy use by nearly a third, relative to the building’s previous performance: a notable achievement for a historic structure on this scale.

Jean Campbell—former senior associate with Beyer Blinder Belle (BBB), the project’s associate architect—credited the success to extensive coordination during the early design phases: “Mueller and BBB’s work to verify existing conditions helped confirm our assumptions for routing all new utilities within the historical fabric. That successful collaboration is evident in this transformational renovation.”

John Rota, senior MEP manager for Gilbane, offered similar praise: “Mueller gave us an excellent design for the Pratt. They have a well-rounded team—everyone in mechanical, electrical, and fire-protection engineering was very competent. Mueller provided some of the best drawings I’ve ever seen. Renovation of an occupied historic building is challenging, but they had obviously done their homework and were responsive throughout construction.”

A Legacy Renewed

When the Library’s renovation was officially completed in September of 2019, the transformation was remarkable. Modern systems operated invisibly behind historical

surfaces, creating comfortable environments for both visitors and the millions of books, documents, photographs, and rare materials housed within. The Central Hall—the Library’s signature space—now functioned as a flexible, multipurpose event venue, while maintaining its historic grandeur.

“I walked through the public spaces during the ribbon-cutting celebration,” Anderson recalled. “Even with the doors constantly open, the temperature and humidity felt consistently comfortable throughout.” This seemingly simple observation represented the culmination of years of planning, modeling, and precise implementation, ensuring that environmental conditions remained stable, despite changing occupancy patterns in a busy public building.

The Enoch Pratt Free Library renovation showcases Mueller’s ability to blend technical innovation with historic preservation, creating systems that meet modern standards while honoring architectural heritage.

More importantly, it upholds Enoch Pratt’s democratic vision, ensuring that this “People’s University” will continue to serve all Baltimore residents for generations—rich and poor, regardless of race or creed—in a building where engineering excellence supports the pursuit of knowledge. Nearly a century and a half later, Mueller’s work ensures that his promise can be kept for generations to come.



John Morris joined Mueller in 1986 and retired in 2018 as Senior Vice President and Chief Mechanical Engineer.

JOHN MORRIS: A CAREER OF PRECISION AND EXCELLENCE

The projects that defined Mueller's 50th-anniversary period were more than technical achievements. They embodied the firm's evolution in sustainable design and complex institutional engineering—capabilities developed over decades by the engineers who had shaped Mueller's culture and expertise. As the firm celebrated its golden anniversary and moved into its new headquarters—a space Senior Vice President John Morris had carefully overseen—it also prepared to honor one of the professionals whose career had been instrumental in building those capabilities.

After more than three decades of exemplary service, John Morris officially retired at the end of 2018, closing a chapter

that had profoundly shaped Mueller's evolution in sustainable design and complex institutional engineering. His departure came just two years after the 50th anniversary celebration, when Richard Mueller and Gene Nerf had stood together, symbolizing the generational continuity that defined the firm. Morris' career represented another link in that chain: a bridge between the firm's founding principles and its future as a leader in sustainable, complex institutional work.

Morris joined Mueller in 1986, fresh from earning a Bachelor of Architectural Engineering degree, with a concentration in Mechanical Engineering, from Penn State University.

Over his 32-year career, Morris became known as one of the firm's hardest-working professionals, setting exceptional standards in both engineering and project management. His expertise in sustainable HVAC systems and meticulous system integration made him an invaluable collaborator with architectural teams tasked with integrating mechanical systems into increasingly complex building designs.

Morris' project portfolio reads like a catalog of Mueller's most significant institutional work: numerous projects for Northrop Grumman, the Walter Reed Army Medical Center, Johns Hopkins University, Towson University, the University of Delaware, and the historic state office complex in Annapolis. His leadership extended across multiple building types and technical challenges, demonstrating Mueller's range and his own versatility as an engineer.

At Wake Forest University Baptist Medical Center in Winston-Salem, North Carolina, Morris played integral roles on countless projects. These included a complex laboratory conversion in 2001, and a comprehensive expansion of the Medical Center's power plant to support a new cancer center a year later.

But the highlight of Morris' career came with the John and Frances Angelos Law Center at the University of Baltimore: the first LEED Platinum law-school building in the nation. As the project's principal-in-charge, Morris led Mueller's team through the intricate challenges involved in integrating sustainable systems into the architect's striking vision. "The client challenged us to create systems that would not just support but enhance the architect's vision for a transparent, daylight-filled learning environment," Morris said. "This demanded thinking beyond conventional approaches to building systems."

The project's success—earning more than 20 design awards, including *Engineering News-Record's* national Best of the Best Award in Higher Education—validated Morris's approach to complex, sustainable engineering.

Beyond his technical accomplishments, Morris embodied Mueller's culture of mentorship and collaboration. President Bob Marino, who had joined Mueller Associates a year before Morris, considered their friendship especially meaningful. "John is one of the hardest-working professionals I've ever known, and he has set exceptional standards of excellence in engineering and project management," Marino wrote to clients, when announcing Morris' retirement.

That guidance extended beyond individual projects to the firm's broader evolution. Morris' oversight of the design for Mueller's new offices in Linthicum reflected his understanding of how physical space shapes collaboration and culture.

John Morris retired at the end of 2018, and returned to his roots in Southwestern Pennsylvania to spend time with family. His departure marked the end of an era for Mueller Associates, but his influence endured in the projects he led, the engineers he mentored, and the standards of excellence he had maintained throughout his career.

Morris' career arc—from young engineer in 1986, to senior vice president and chief mechanical engineer overseeing quality across the firm—illustrated Mueller Associates' enduring commitment to developing talent and promoting from within. The same mentorship culture that had shaped Gene Nerf's career in the 1970s, and Bob Marino's in the 1980s, had enabled John Morris to grow into a leader whose "guidance and critical eye" became essential to Mueller's most ambitious work.



CHAPTER 10

Meeting New Challenges

By the end of the 2010s, Mueller Associates had established itself as a preeminent engineering firm for complex institutional projects, including museums, libraries, laboratories, health-science facilities, and performing and fine arts centers. The firm's ability to thread modern systems through historic structures, maintaining precise environmental control while buildings remained operational, had been tested and proven across hundreds of demanding projects. The expertise the firm had honed over 50 years—meticulous planning, creative problem-solving, deep collaboration with clients and architects—had become second nature. These skills would soon be tested in ways no one could have imagined.

An Invisible Threat

When COVID-19 swept across the globe in early 2020, it upended nearly every aspect of everyday life. Offices emptied, schools closed, and institutions of every kind scrambled to understand how a microscopic virus could spread so readily through the very air people breathed.

For Mueller Associates, the pandemic presented both a profound challenge and an unexpected opportunity. The firm had spent decades engineering precise indoor environments: controlling temperature, humidity, and air quality, both for museums tasked with protecting priceless collections, and for laboratories requiring strict environmental conditions. Now those same principles of heating, cooling, dehumidification, humidification, ventilation, and air distribution had become urgent public concerns. Mueller's engineers had long advised clients on strategies for improving indoor air quality. Suddenly, everyone was listening and paying very close attention.

Essential Work in Unprecedented Times

The pandemic moved with stunning speed. On January 20, 2020, the Centers for Disease Control (CDC) reported the first laboratory-confirmed case of COVID-19 in the U.S. In Maryland, by late February, three people had tested positive for the virus. In early March, several new cases cropped up—all at colleges and universities—forcing the University of Maryland, College Park; the University of Maryland, Baltimore County; Towson University; the University of Maryland, Eastern Shore; and Salisbury University to close campuses and switch to online classes.

By March 12, a dozen cases had been confirmed in the state, and Maryland's Superintendent of Schools announced that all public schools would close for two weeks. The next day, there were six new cases, followed by seven more the following day. Within a week, the Preakness Stakes, scheduled to take place at Baltimore's historic Pimlico Race Course, was postponed for the first time in its 145-year history.

On March 23, Maryland's governor issued emergency stay-at-home orders, closing non-essential businesses. The

state's confirmed cases now totaled 149. In a single afternoon, Mueller's employees hastily gathered their belongings, including task chairs and other workplace essentials, packing them for their new work-from-home offices. Amid the uncertainty, Mueller's leadership remained in contact with company staff, and promptly issued a detailed memo to all employees, announcing a temporary telecommuting policy. "None of us has ever been through a situation such as this," they acknowledged, "and it can be unnerving and stressful. Social distancing is an unfamiliar and unpleasant experience for most. Now more than ever, it is important to communicate with each other on a regular basis." That evening, the state confirmed its second death due to COVID-19.

The following day, Mueller Associates instructed all staff to work from home. But their work could not stop. As an engineering firm serving government, defense, and other facilities—all critical to front-line activities—Mueller was classified as an essential business under Maryland's emergency orders. President Bob Marino personally signed letters certifying that employees traveling to the office or project sites were engaged in essential engineering work. These documents allowed them to pass through areas that had suddenly gone quiet.

The shift to remote work demanded quick adaptation. The firm's technological infrastructure, including web-based access, was sufficient to support a distributed workforce in the short term, but could not be sustained in the long run. This ultimately led to a company-wide reassessment of resources, including remote access and technology. Engineering is naturally collaborative—especially at Mueller, which has fostered a culture focused on mentor-mentee relationships, along with hands-on, in-person training. The sudden separation of project teams created real and significant challenges.

Employees struggled to log in remotely to their work computers, since their desktops remained at the office. Many had never worked remotely before, and lacked proper setups in makeshift home offices, using bedrooms or dining-room tables. Mueller Associates distributed spare monitors, and coordinated equipment needs on an individual basis.

“These are unique circumstances, and they change on a daily and sometimes hourly basis,” wrote the principals in a memo to Mueller staff. They asked employees to share ideas to enhance communication and collaboration while working from different locations, recognizing that the firm would need to learn and adapt together.

The shift to remote work uncovered something vital about Mueller Associates. For more than 50 years, the firm had built a culture of mentorship: senior engineers guiding younger colleagues through the complexities of institutional projects, and sharing knowledge through collaboration at nearby workstations, rather than through manuals. That culture could not be re-created through video calls. Within weeks, even employees who had initially appreciated the flexibility of working from home started to feel the loss. Younger engineers, especially, discovered that their hands-on learning—quick questions, over-the-shoulder reviews of drawings, spontaneous problem-solving sessions—could not happen remotely. By late spring of 2020, Mueller’s leadership knew that bringing people back safely was not just a logistical challenge; it was an organizational necessity.

Engineering a Safe Return

As spring turned to summer, Mueller’s leadership began planning for a phased return to the office. This effort drew upon the same methodical, research-driven approach that

characterized the firm’s engineering work. Officers participated in numerous return-to-work webinars, studied guidelines from the CDC and the Occupational Safety and Health Administration (OSHA), and consulted with insurance carriers and peer firms.

On May 22—approximately two months after the Maryland governor’s stay-at-home order—the firm’s leadership issued a comprehensive memo outlining protocols for returning to the office, beginning June 15. The document reflected Mueller’s expertise in building systems: the very systems now being scrutinized as potential vectors for disease. In coordination with the office building’s owners, Mueller’s leadership announced that the office’s HVAC systems would operate on extended hours, running from 5:00 a.m. to 8:00 p.m. on weekdays. Air from outside ventilation would increase from 20% to 30%, pending the ability to maintain indoor temperature and humidity setpoints. Air-handling-unit filters would be replaced quarterly, under a preventative maintenance contract.

Within the Mueller office itself, the firm implemented an alternating schedule that divided project teams into “A” and “B” groups, with each group reporting on Monday, Wednesday, and Friday one week, and on Tuesday and Thursday the following week. This arrangement ensured that no more than half the staff were in the office on any given day, while still allowing in-person collaboration for complex projects. Color-coded floor plans—teams designated by black, red, gray, and orange—mapped out the new workplace reality.

These protocols extended to every corner of daily work life. On June 15, when the first wave of employees returned under the alternating schedule, the Mueller office felt simultaneously familiar and strange. Engineers arriving at

the front door—now designated for entry only—found color-coded floor plans posted throughout the building. The large conference room, where project teams had once gathered around a single table, now held a maximum of six people. The break room—once a gathering spot for impromptu conversations over coffee—had become a two-person space. The coffee maker sat unplugged. The water cooler, refrigerator, and microwave were off-limits. No shared food would be permitted—no catering, no delivery, and none of the potluck lunches that had once brought Mueller’s engineering teams together.

Personal facemasks became mandatory whenever employees left their workstations. Mueller provided safety glasses, disposable masks, and gloves for field-survey work. Hand-sanitizer stations appeared throughout the office. Every employee was expected to wipe down their workstation, keyboard, and phone upon arrival, and upon leaving each day. “Your safety and well-being are of utmost importance to us,” the principals wrote in their memo. And then, in a line that captured the human dimension of the crisis: “Be kind. Understand that this is a stressful time for everyone, some more than others.”

Thought Leadership in a Crisis

Even as Mueller Associates navigated its own operational challenges, the firm recognized that its expertise could serve a greater purpose.

The pandemic had thrust HVAC systems into the spotlight, as building owners, facility managers, and the public grappled with questions about how readily the virus spread through indoor air. For the engineers at Mueller, this was familiar territory, although the stakes had never been higher. Paul Czajkowski, Mueller’s chief mechanical engineer, led

the company’s pandemic response. Czajkowski had joined Mueller in early June 1980 and, over the next four decades, became one of the firm’s most respected technical experts, especially in relation to complex mechanical ventilation systems. As reports of the airborne transmission of SARS-CoV-2 emerged in early 2020, Czajkowski delved into rapidly evolving research from ASHRAE’s newly formed Epidemic Task Force. By May 2020, he had compiled this technical information into a detailed memo, “SARS-CoV-2 / COVID-19—HVAC Considerations and Recommendations.”

The memorandum reflected Czajkowski’s characteristic thoroughness, as well as his understanding of how to translate technical research into practical guidance. It provided essential background on infectious aerosolized transmission, and explained how HVAC systems could either reduce or increase exposure to airborne pathogens. Drawing primarily upon ASHRAE’s “Position Document on Infectious Aerosols,” and communications from its Epidemic Task Force, Czajkowski outlined the fundamental principle that would guide Mueller’s pandemic work: “Transmission of SARS-CoV-2 through the air is sufficiently likely that airborne exposure to the virus should be controlled. Changes to building operations, including the operation of heating, ventilating, and air-conditioning systems, can reduce airborne exposures.”

The core of the memo focused on detailed strategies to lower the risk of infection by modifying HVAC systems. Czajkowski categorized the recommendations into nine specific categories: increasing ventilation using outdoor air; improving filtration to MERV 13 or higher; adding ultraviolet germicidal irradiation where suitable; maintaining optimal temperature and humidity levels; managing pressure differences; optimizing airflow patterns; extending system-operating hours; addressing energy-recovery systems; and

adding anterooms in high-risk zones. Each strategy included practical advice on implementation challenges. For example, regarding increased ventilation, Czajkowski warned that “the extent to which this can be done depends upon several factors including, but not limited to, the size of the outside air intake and ductwork, capacity of the AHU heating coil and cooling coil, and outdoor air temperature and humidity.”

This attention to practical constraints reflected Mueller’s approach to the pandemic: providing authoritative technical guidance, while recognizing the real-world limitations of existing systems. As Czajkowski emphasized in the memorandum, “For existing buildings (with existing HVAC systems), the options that are practical for implementation will be influenced by the constraints of the existing conditions, similar to any modification or alteration project.” He stressed that a careful assessment was essential before implementing any strategy, noting that inadequate evaluation could lead to operational shortcomings. Some examples included loss of environmental control when increased outdoor air loads exceeded coil capacities, or decreased airflow rates resulting from an increased drop in filter pressure: unintended consequences that could create new problems while attempting to address COVID-19 concerns.

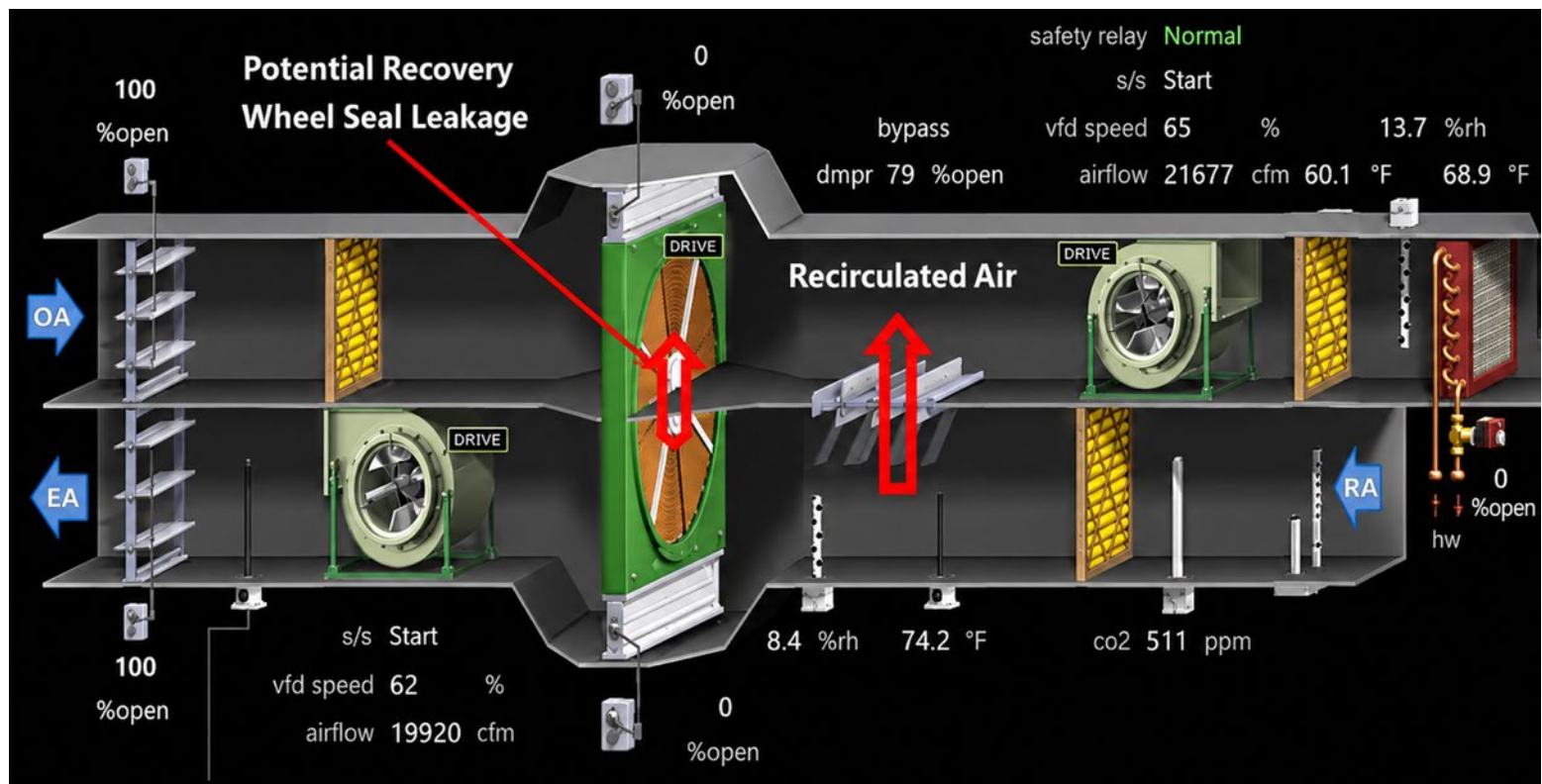
On May 11, Czajkowski distributed the memo to Mueller’s project managers with clear instructions: meet with every client, assess every system, and act urgently upon projects where equipment decisions were imminent. “The next several weeks could be critical for this, and represent potentially many opportunities to serve clients,” he wrote. It was a prescient observation about both the pandemic’s trajectory, and Mueller’s potential to provide meaningful assistance.

Mueller Associates’ approach was both systematic and urgent. Czajkowski prioritized projects under construction,

recognizing that engineering recommendations could affect equipment already in production, or soon to be manufactured. Mueller wanted to achieve the best possible results for clients and, if there were opportunities to improve the client’s ability to resist the spread of COVID-19 through equipment type, every effort should be made to achieve that, even if it meant recommending changes to equipment during the procurement process. Projects still being designed also required immediate attention, but were not as urgent as those under construction, because they offered greater flexibility when it came to making changes.

Another priority involved existing facilities, where building owners needed to evaluate system readiness for reopening. For these, Mueller determined the necessary modifications to existing equipment and systems, including their operation, to help ensure the safest possible environment from an HVAC standpoint. Notable projects for which Mueller provided an evaluation of existing HVAC systems were Loyola University Maryland’s campus in Baltimore and Ford’s Theatre in Washington, D.C., a National Historic Site administered by the National Park Service.

Under Czajkowski’s guidance, Mueller’s engineers collaborated with clients to evaluate systems and explore modifications to reduce the risk of infection. Projects still at the design stage were revisited to incorporate the recommendations of ASHRAE’s Epidemic Task Force. Construction projects underwent review to determine if upgrades could be integrated before systems were finalized. Existing facilities received assessments of their readiness for safe reopening, with recommendations customized to each building’s specific systems, occupancy patterns, and operational constraints. ASHRAE’s recommendations continued to develop and evolve—a moving target—resulting in changes to Mueller’s work during the COVID-19 era.



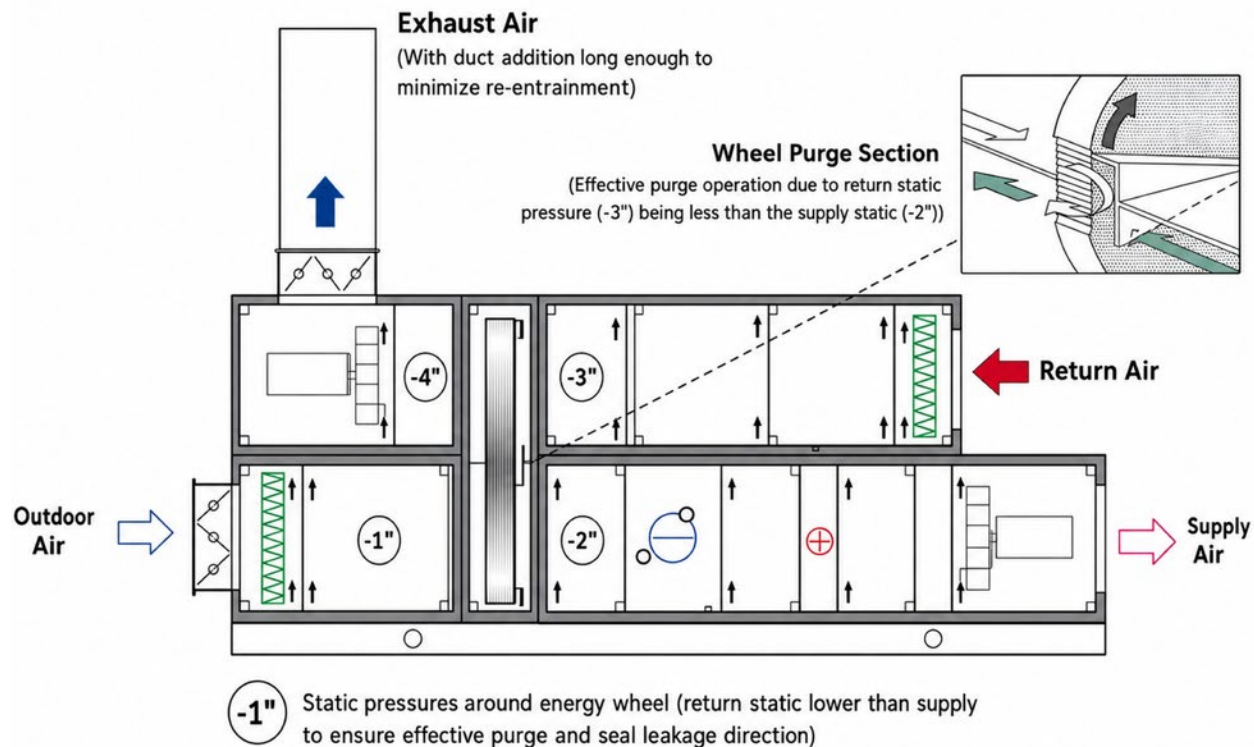
In his pandemic webinars, Todd Garing, Mueller's senior vice-president, walked facility managers through risks like this one: an energy-recovery wheel whose seal leakage can draw exhaust back into the recirculated airstream.

Czajkowski's memo also served as a teaching resource, ensuring that all of Mueller's engineers—regardless of their field or level of experience—understood the strategies for controlling the transmission of airborne diseases in relation to their work. "All Mueller engineers need to have a working knowledge of these strategies, as far as they apply to their particular discipline," Czajkowski wrote in his communications with the staff.

In May, Mueller Associates published its comprehensive guidance on "Reducing the Potential Transmission of Coronavirus Through HVAC System Design, Operation, and Maintenance." The document synthesized the most up-to-date recommendations from ASHRAE's position document, and transformed engineering principles into practical recommendations that owners could implement immediately.

In addition to Czajkowski, Todd Garing, who had joined the firm in 1993 and was now senior vice president, became a sought-after expert on pandemic-related issues in building systems. His virtual presentation, "HVAC System Design, Operation, and Maintenance in the Age of COVID," connected with audiences through the International Association of Museum Facility Administrators (IAMFA) and other professional organizations. For the cultural institutions Mueller had served for decades—museums housing priceless collections requiring precise environmental controls—Garing's guidance helped to navigate the complex challenge of protecting both human health and irreplaceable artifacts.

Similarly, Garing's webinar for the American Alliance of Museums (AAM) Environmental and Climate Network, "Navigating the Issues of Air Filtration," became a crucial



Garing's presentations also showed the remedy. This schematic maps how a wheel-purge section separates exhaust from supply air, limiting the re-entrainment of contaminated air.

resource for institutions across the country. Both presentations addressed the questions that facility managers were asking: How effective were different filter ratings at capturing virus-laden particles? What were the tradeoffs between increased filtration and energy consumption? How could existing systems be optimized without costly renovations?

By August 2020, as the initial shock of the COVID-19 pandemic gave way to a longer-term reality, Mueller Associates issued guidelines to its staff about work at client facilities. The protocols ensured that employees conducting field surveys, attending client meetings, or observing construction would maintain the same rigorous safety standards, whether in the office or onsite. Personal face masks, safety glasses, hard hats, and disposable gloves became standard equipment. Employees were required to log all time away

from the office, so that contact tracing could be done, if needed.

COVID-19 had reshaped the architecture, engineering, and construction industry in ways that were only just beginning to become clear. Remote-collaboration tools that had once seemed like temporary solutions would become permanent fixtures. Questions about indoor air quality and ventilation that had previously only concerned specialists entered mainstream conversation. And the expertise Mueller Associates had accumulated over decades in designing cultural, education, and health-sciences facilities would demonstrate its value during this crisis.



A CAMPUS WITHIN A BUILDING: VIRGINIA COMMONWEALTH UNIVERSITY'S COLLEGE OF HEALTH PROFESSIONS

In the heart of downtown Richmond, Virginia, and just a few blocks from the State Capitol, Virginia Commonwealth University's **College of Health Professions** (CHP) had long operated from scattered facilities across campus. Students pursuing careers in gerontology, nurse anesthesia, radiation sciences, and physical therapy moved between buildings, their programs isolated from one another, despite the increasingly collaborative nature of modern healthcare. When VCU decided to mark the 50th anniversary of its health professions programs with a new building that would unite all 11 allied health disciplines under one roof, the University turned to Stantec, (formerly EYP Architecture

and Page), to design it, and to Mueller to engineer the complex systems that would bring their vision to life.

The challenge was formidable. At eight stories and 154,000 square feet, the new CHP building would feel less like a single structure than a small campus compressed into a vertical footprint. The site itself was tightly constrained, wedged onto the edge of a quadrangle that served as a pedestrian crossroads between VCU's healthcare facilities and the Bio + Tech Park. The building needed to accommodate not just classrooms and offices, but also advanced simulation laboratories, a double-height biomechanics research lab,



Training the next generation of caregivers begins at VCU's CHP. The building's simulation suites, students work through lifelike scenarios so that, one day, they will be ready for actual patients.

maker spaces, diagnostic technology suites, and a 160-seat auditorium, while achieving LEED Silver certification and creating the kind of open, collaborative environment that would prepare students to work across disciplinary boundaries.

Mueller Associates developed a variety of solutions to meet the building's complex needs. The team designed an efficient chilled-water plant and custom rooftop air-handling units with energy-recovery heat wheels, along with variable-volume air supply and perimeter fin-tube radiant heating. Extensive metering provided feedback data to track loads, enabling efficient equipment operation. To further enhance energy efficiency, Mueller created control strategies that included dimming, vacancy and occupancy sensing, daylight harvesting, and time-of-day scheduling.

The building's scope and complexity created challenges that Chuck Swope, Mueller's chief mechanical engineer, would later describe in *Plumbing Engineer* magazine as both familiar and unprecedented. Some issues—providing laboratory-grade water, managing drainage for multiple wet-bench stations—were common enough in higher-education laboratory spaces. Others emerged from this specific building's unusual compression of an entire campus into a vertical footprint.

“The Only Way to Know It Was Raining”

One of the first challenges Mueller's engineers confronted was sound. The large glass-front auditorium occupied a prominent position on CHP's first floor, and was available to all college departments for lectures and events. Stormwater

pipng from throughout the building collected in an area adjacent to the auditorium, with one of the mains running directly through the space. In most buildings, engineers would simply route utilities away from acoustically sensitive areas. Here, the building's compact footprint made that impossible.

Mueller's solution leveraged decades of experience designing systems for performing arts centers and museums. The team specified cast-iron piping throughout the gravity-drainage system: material that, according to the Cast Iron Soil Pipe Institute, can result in a system that is up to 11 times quieter than all-plastic options. Mueller's engineers then added a mass-loaded vinyl blanket to the piping as sound insulation. The heavier the piping, the more sound energy it absorbs, rather than transmits. "Between Mueller's cast-iron drain-piping system and sound-insulating designs, combined with architectural attenuation," Swope said, "looking outside the auditorium's windows was the only way to know it was raining."

Pressure and Flow

Water pressure posed another challenge. The building's eight floors needed a domestic-water booster pump to reach the top, but sizing the pump for the entire load would have been inefficient. Mueller's engineers examined the building's layout, and found that key fixtures and equipment were mainly on the upper floors, while the first and second had primarily lecture halls and a public restroom that could be supplied directly via street water pressure. By creatively zoning the domestic water system, they reduced the booster pump's flow requirement from 200 gallons per minute to 160—a 20% reduction that saved energy and enabled them to move from a triplex system with 15-horsepower pumps to a simpler setup with 10-horsepower units.

The most distinctive feature of the building was the Smart Home Apartment on the second floor. This fully functional residential unit was designed to train students in occupational therapy, physical therapy, and gerontology, toward helping people with disabilities live as independently as possible. The apartment included a kitchen, bedroom, and bathroom, but nothing about it was ordinary. The bathroom and toilet were engineered to withstand a static load of more than 500 pounds. The shower featured a long-reach handheld unit, rather than a traditional showerhead, accommodating users with limited mobility. Students would learn how to assess patients' homes and recommend modifications: skills that will prove invaluable as America's population ages.

On the third floor, the building's simulation and imaging suites allowed future surgical staff from the Nurse Anesthesia and Radiation Sciences programs to practice in environments that replicated the equipment they would eventually use to treat cancer patients. Each surgical suite featured headwall units with connections for oxygen, vacuum, compressed air, and nitrous oxide. The Virtual Environmental Radiotherapy Training Simulation Lab enabled students to explore treatment techniques using simulators similar to those used by pilots for flight training. Special features in a nearby control room allowed instructors to simulate emergencies—such as oxygen or power loss—so that students could learn to respond to crises in high-pressure situations before working with real patients.

The sixth floor housed the building's most advanced plumbing systems. Here, Medical Laboratory Sciences (MLS) students used a comprehensive teaching laboratory equipped with microscopes, centrifuges, and mass spectrometers to analyze body fluids and tissues. Despite the field's critical importance—MLS professionals provide



VCU compressed an entire health-sciences campus into eight stories: surgical and radiotherapy simulation suites, imaging labs, a biomechanics research lab, maker spaces, and diagnostic teaching labs like this one, where medical laboratory sciences students train.

the information underlying more than 70% of all physician diagnoses—an acute shortage of practitioners have persisted, partly because the field has remained relatively unknown. The laboratory’s 48 wet-bench stations, served by integral cup sinks and deep-basin epoxy sinks, required chemically resistant polypropylene waste and vent systems. A sophisticated water-purification system with reverse osmosis supplied CLSI Type I, 18 megaohm water—one of the highest achievable standards for pure water.

When the building opened and earned LEED Silver certification, it represented more than just an architectural milestone. “This building, which is gorgeous, is also incredibly functional,” observed Susan Parish, Dean of the College of

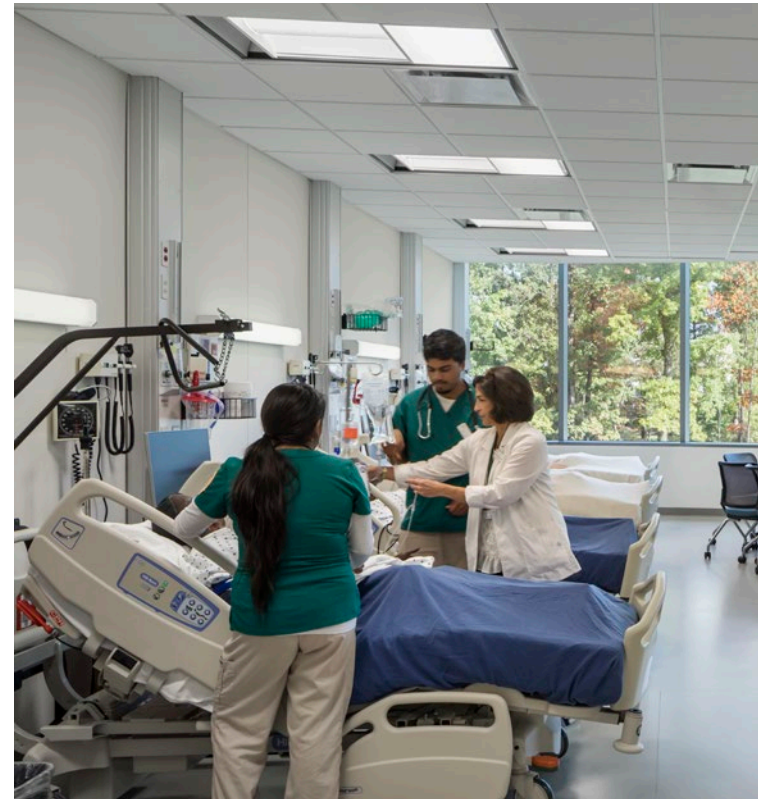
Health Professions. “And it will allow us to train our students to work together and collaborate, so that they don’t just remain within the silos of their disciplines.” The building had become, in the words of former dean Cecil Drain, a place where students would be “prepared for working with other occupations,” long before they entered hospitals and clinics.



A CAMPUS GATEWAY: GEORGE MASON UNIVERSITY'S PETERSON FAMILY HEALTH SCIENCES HALL

At George Mason University's Fairfax campus, a similar transformation had taken shape. The **Peterson Family Health Sciences Hall**, designed by Perkins Eastman, would become the second-largest building on any of Mason's campuses. This 165,000-square-foot flagship brought together the University's programs in nursing, rehabilitation sciences, social work, health administration, global and community health, and nutrition under one roof.

The building features five signature spaces: a Nutrition Kitchen Lab, a Health Informatics Learning Lab, a Functional Performance Lab, a Patient Simulation Lab, and a Community Health Institute. The Nutrition Kitchen allows professors to control remote cameras by pressing buttons on the floor, while students work at individual stovetops. The simulation labs include cameras mounted over beds, enabling students' clinical work to be recorded and reviewed. On the third floor,



Replicating a hospital takes hospital-grade systems. At Mason's Peterson Family Health Sciences Hall, Mueller designed custom outdoor air-handling units that feed the building, delivering highly controlled spaces with the environmental control that clinical training demands.

wet-lab spaces deliver natural gas, vacuum air, compressed air, and reverse-osmosis-treated water from the ceiling to benchtops, for hands-on research. Standalone clinic spaces on the first and second floors provide primary and urgent care services, including an MRI suite, and a telemedicine exam room with audio and video capabilities, allowing physicians to connect with patients worldwide.

Mueller's engineering designs supported these sophisticated spaces with systems tailored to the building's complex requirements. Seven custom outdoor air-handling units with internal service corridors deliver nearly 150,000 cubic feet per minute of supply air to the building. Recirculating air-handling units recover both sensible and latent energy

using total-energy-recovery wheels. A separate lab air-handling unit captures sensible heat from fume-hood spaces in a heat pipe, then sends it through high-plume exhaust fans. A direct digital control (DDC) system integrates with the campus network and employs energy-saving strategies, including adjustable pressure and temperature resets, and demand-controlled ventilation based on carbon dioxide sensors.

"This building is an investment in people," said Dr. Germaine Louis, PhD, Dean of Mason's College of Health and Human Services. "The building signifies innovative thinking, discovery, and service, while also ensuring that students have life-long skills to advance health for all people."



COLLABORATION ACROSS DISCIPLINES: DUKE UNIVERSITY'S INTERPROFESSIONAL EDUCATION AND CARE BUILDING

Mueller Associates' relationship with Duke University in Durham, North Carolina, has spanned several decades—including two phases of the School of Nursing complex, completed in 2006 and 2014; and the Rubenstein Arts Center, completed in 2018. When Duke decided to expand again with a new **Interprofessional Education and Care Building** in 2019, the university naturally turned to Mueller and architect Ayers Saint Gross once more.

The five-story building, connected to the existing nursing facilities by a three-story pedestrian bridge, unified programs that had traditionally operated separately. The Department of Orthopaedic Surgery and the Doctor of Physical Therapy program now share space with the School

of Nursing, fostering collaborative education that is transforming healthcare delivery. Mueller provided comprehensive mechanical, electrical, plumbing, and fire-protection services for the LEED Gold building.

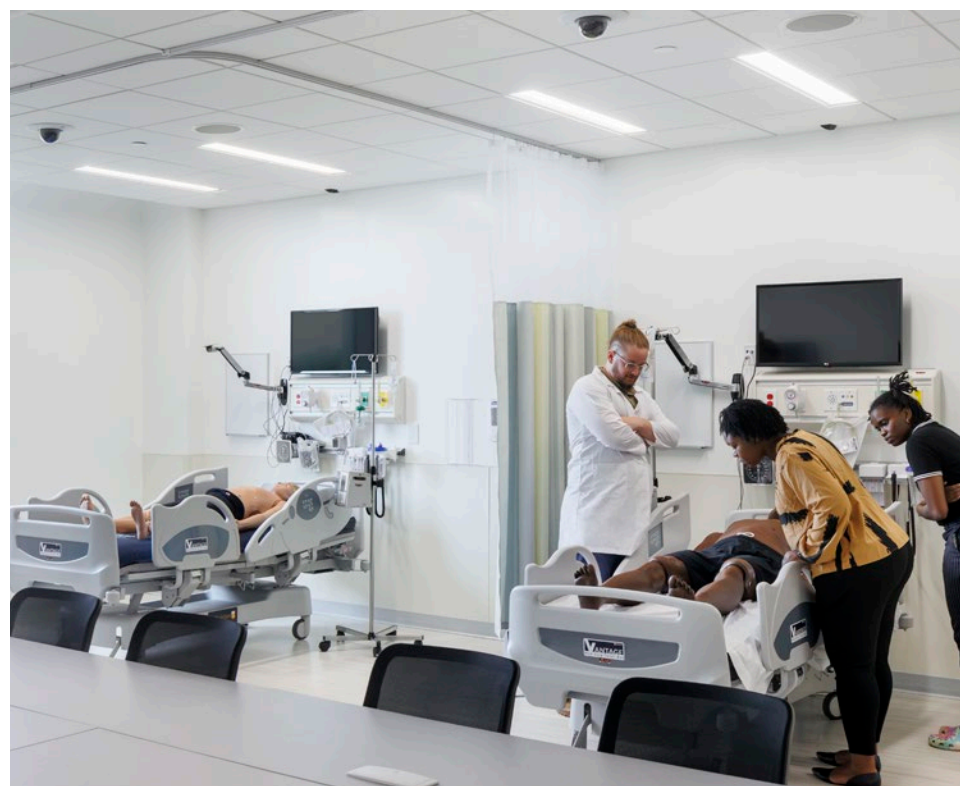
"The ability to co-locate orthopaedic surgery and physical therapy with the School of Nursing allows us to focus on a new office of Interprofessional Education that will teach students the value of patient-centered care across multiple medical disciplines," said Mary E. Klotman, MD, Executive Vice President for Health Affairs and Dean of the Duke University School of Medicine. "By virtually every measure—patient outcomes, research advances, efficiency, cost savings, and so on—partnering up offers big advantages."

ADDRESSING RURAL HEALTH DISPARITIES: UNIVERSITY OF MARYLAND, EASTERN SHORE'S SCHOOL OF PHARMACY AND HEALTH PROFESSIONS

Mueller Associates' relationship with the University of Maryland, Eastern Shore (UMES) stretches back more than five decades. The connection began in 1968—just two years after the firm's formation. Over this ensuing period, Mueller delivered engineering services on multiple projects. Among the most ambitious was the **Engineering and Aviation Science Complex**, completed in 2015, and designed by Hord Coplan Macht in collaboration with Perkins&Will.

The 166,000-square-foot building achieved LEED Gold certification, primarily because of its innovative geothermal-energy system. Two hundred and twenty wells, drilled deep into the soil of the Eastern Shore, provide sustainable heating and cooling. Variable-flow pumping systems with frequency-controlled motors adjust output to match real-time demand, minimizing energy use during part-load conditions. The geothermal system represents a significant investment in campus sustainability—and, for students in the building's engineering and technology programs, it doubles as a teaching tool, offering real-world exposure to the renewable-energy systems shaping tomorrow's built environment.

UMES also has a distinction that few other institutions can claim: it offers more health-professions programs than any other Historically Black College or University (HBCU) in the nation. Yet, for years, the School of Pharmacy and Health Professions had operated from scattered facilities across campus, with no central home to call its own. The new 120,000-square-foot **School of Pharmacy and Health**



Professions building, designed by architectural firms Ayers Saint Gross and Shepley Bulfinch, would change that. The facility consolidated programs in pharmacy, pharmaceutical sciences, physician-assistant studies, kinesiology, physical therapy, and rehabilitation services into a single state-of-the-art complex. Mueller engineered high-performance systems to support specialized research laboratories, simulation spaces, and teaching environments that would prepare students to address the pressing health disparities affecting rural communities across the Delmarva.



A NEW FRONT DOOR: TYLER HALL AT MORGAN STATE UNIVERSITY

Morgan State University (MSU) has occupied its campus in Northeast Baltimore since 1917, with a rich architectural heritage spanning Neoclassical, Brutalist, and Modern styles. When David Wilson became the University's president in 2010, he launched an ambitious program of "capital eminence," renovating or replacing underutilized buildings to signal that MSU was a preeminent research university committed to its students' success. The linchpin of this vision was a new student services building that would serve as the University's symbolic front door.

Calvin and Tina Tyler Hall, designed by Baltimore's GWWO Architects and Toronto-based Teeple Architects, opened in September 2020—on schedule despite the pandemic's disruptions. The 139,000-square-foot building gathered previously dispersed student services under one roof: admissions, financial aid, registrar, career services, and student affairs. Its location was chosen specifically to bridge the gap between Morgan's historic academic quad and the modern campus commons, creating a gateway that welcomed both prospective students and the surrounding community.



Mueller Associates provided comprehensive mechanical engineering services for the LEED Gold building. The Hall is connected to MSU's central chilled-water distribution system, and incorporates a dedicated heating plant to ensure reliable comfort year-round.

The building's expressive architecture—sweeping curved walls, dramatic cantilevers, expanses of glass curtain wall, and distinctive dark Eramosa limestone—created a bold modern presence, while connecting to the traditional masonry found throughout the campus. A three-story atrium flooded interior spaces with natural light, while a 250-seat auditorium served as a gathering space for campus events.

Mueller's partnership with MSU stretches back more than three decades, beginning in the early 1990s with a series of renovations—alterations to Carter-Grant Wilson Administrative Hall and McMechen Hall in 1992—and grew, over the years, into work on some of the campus's most visible buildings. In addition to Tyler Hall's welcoming front door, Mueller worked on the **Earl G. Graves School of Business and Management**, which rose on the ground where Morgan students had marched for civil rights in 1963.

Tyler Hall was conceived as Morgan State's symbolic front door, and this soaring atrium makes the welcome tangible—a gathering place built to draw students and community alike.



INNOVATION AND COLLABORATION: LOYOLA UNIVERSITY MARYLAND'S MIGUEL B. FERNANDEZ CENTER FOR INNOVATION AND COLLABORATIVE LEARNING

Mueller Associates' relationship with Loyola University Maryland in Baltimore spans more than a quarter-century, beginning with alterations and additions to College Center East in 1999. The firm provided engineering services for renovations of Jenkins Hall in 2001, followed by a comprehensive master plan in 2003.

Much of Mueller's subsequent work on campus centered on the **Donnelly Science Center**: additions and renovations in 2011, an HVAC study and design upgrades in 2013, and upgrades to the central chilled-water cooling plant in 2021 and 2024. When the COVID-19 pandemic struck in 2020, Mueller conducted an HVAC systems assessment to help the

University understand how its buildings could be operated more safely. During the same period, the firm completed one of its most significant projects at Loyola.

The **Miguel B. Fernandez Center for Innovation and Collaborative Learning** opened in September 2021, marking a new chapter in the Jesuit institution's nearly 170-year history. The project combined a 35,000-square-foot addition with the renovation of historic Beatty Hall, doubling the building's size and creating a dynamic gateway to campus.

Working with Shepley Bulfinch as the project's architect, Mueller Associates delivered comprehensive MEP

engineering services that supported the University's ambitious sustainability goals. The building featured a state-of-the-art air-handling unit with UV-C arrays for enhanced air purification—a feature that took on new significance in the post-pandemic era. One hundred percent LED lighting with daylight-responsive controls, water-efficient plumbing fixtures that reduced annual consumption by 40%, and high-performance glazing contributed to the building's environmental performance. A living bio-wall near the café supported biophilic design principles while improving indoor air quality.

The project achieved LEED Gold certification, making it Loyola's first LEED-certified building. "Mueller worked hand in hand with the Loyola team to recognize our ambitious LEED goals for the new Fernandez Center," said Meredith Sullivan, director of project management for design and construction at Loyola. "The collaboration between the design team, contractor, and owner resulted in our first LEED-certified building on campus. Tasked with a goal of Silver, Mueller was able to propose innovative and forward-thinking engineering solutions, which resulted in the project achieving Gold certification."

"BEARING" THE COLD: MUELLER TAKES THE PLUNGE

In 1996, a handful of Maryland State Troopers conceived a bold idea to raise money for Special Olympics Maryland (SOMD): they would jump into the icy waters of the Chesapeake Bay 24 times—once every hour—over the course of 24 hours. That stunt inspired what became the Maryland State Police Polar Bear Plunge, now one of the most successful annual fundraisers on the East Coast.

Mueller Associates became a supporter of SOMD in 2016, with employees participating in the Polar Bear Plunge and other fundraising initiatives. The firm's commitment deepened in 2024 when Bob Marino, Mueller's fourth president, became Chairman of the Board of Directors for SOMD—bringing the same dedication to serving athletes with intellectual disabilities that he had brought to Mueller.

Over the past decade, hundreds of Mueller employees, friends, and partners have taken the plunge together. For many, participating in the annual SOMD plunge is personal. "At Mueller, we care about the projects that we engineer, and the impact that we have on our community," reflected

Matt Velky, a project manager at the firm. "It just feels amazing to be part of something bigger, to do something meaningful," said Thea Postolache, mechanical project engineer. For Senior Chief Mechanical Engineer Paul Czajkowski, "The entire Mueller company coming together builds camaraderie." Marino simply stated, "We're trying to build a culture at Mueller where it's not just about engineering. Participating in the Plunge feeds the spirit within our firm."

Even during the COVID-19 pandemic, Mueller's support of SOMD did not waver. In January 2021, dozens of staff participated virtually in a synchronized plunge, jumping into local streams and backyard pools, climbing into ice-filled bathtubs, or dousing themselves with cold water from buckets and hoses.

To date, the firm has raised more than \$200,000 for SOMD. This continued commitment reflects values that have animated the firm from its earliest days: engineering is ultimately about serving people, and creating environments in which they can learn, heal, discover, and thrive.



Since 2016, Mueller employees, friends, and partners have braved the frigid Chesapeake Bay at Sandy Point State Park for the annual Polar Bear Plunge, raising more than \$200,000 for Special Olympics Maryland. For a firm whose work points beyond engineering, this tradition has become part of who they are.

A CULTURE OF RECOGNITION AND LEADERSHIP

In the early 2020s, Mueller Associates' dedication to developing talent and professional growth continued to earn industry recognition. In 2022, the International Association of Museum Facility Administrators (IAMFA) awarded Mueller its Diplomat Award, acknowledging decades of contributions to the museum facility field. As one of the association's original corporate sponsors, Mueller had spent a decade contributing articles to IAMFA's magazine, *Papyrus*, and delivering educational sessions to its members. The award, said IAMFA president Nancy J. Bechtol, recognized the firm's "vision and leadership."

That investment in people also drew notice beyond the firm's walls. In 2020, Project Manager Karen Schulte was named

to *Consulting-Specifying Engineer's* national "40 Under 40" list, honoring the next generation of leadership in mechanical and electrical engineering; three years later, *Engineered Systems* named Project Manager Rebecca Fischer among the top 20 women in mechanical engineering.

These honors reflected a deliberate effort to cultivate leadership from within, ensuring that the mentorship culture established by the firm's founders continued to shape the next generation—the clearest expression of a company that had always understood engineering as, ultimately, a way of serving people.



CHAPTER 11

Leadership Transition and Future Vision

On September 17, 2021, in a hospital near his home in Pompano Beach, Florida, Richard Mueller passed away at the age of 92. The news quickly reached the firm's leaders. Bob Marino, who had led Mueller Associates as president and CEO since 2006, reflected upon what the founder had meant to the firm, and to those who had worked alongside him.

"Richard Mueller was instrumental in establishing the exceptional reputation that our firm continues to enjoy today," said Marino, adding:

"He was an ideal leader for those foundational years. Richard was an excellent engineer, a remarkable judge of talent, an inspirational mentor, and a visionary in understanding that the MEP engineering profession should readily embrace emerging technologies and innovations. Most importantly, he understood the importance of cultivating long-term client relationships. He valued the client's perspective above all, and emphasized trust, integrity, and accountability in everything we do."

Richard Paul ‘Dick’ Mueller

Founder of Baltimore-area engineering firm Mueller Associates strived to be at ‘the forefront of innovation’

By Alex Mann

Richard Paul “Dick” Mueller, founder and former president of Mueller Associates, a Baltimore-area engineering firm that’s worked on some of the area’s iconic institutions, died of complications of an infection Sept. 17 at a hospital near his home in Pompano Beach, Florida. He was 92.

The son of Anna nee Rau, a secretary for Seaboard Steel, and Harry C. Mueller Sr., who died when Mueller was a young boy, Mueller was born in Baltimore in 1929.

He and his late brother, Harry C. Mueller Jr., grew up modestly and were a handful for their mother, said his son, Paul Mueller, 59, of Sykesville. Mueller learned to appreciate the sacrifices his mother made for them and her emphasis on the importance of higher education.

Mueller graduated from Baltimore Polytechnic Institute in 1949 after taking leave to serve in the U.S. Army from 1946 to 1948 during its occupation of Korea, according to a family obituary. Shortly thereafter, he enrolled in the engineering program at the Johns Hopkins University, completing his freshman year before entering the field in 1950.

That’s around the time he met his first of three wives, Marilyn Rohrs, with whom he raised six children in Catonsville. After about 30 years, the marriage ended in divorce, Paul Mueller said.

He graduated from Hopkins in 1960 with a bachelor’s degree in engineering, having taken classes at night while working and raising a family, according to the family obituary.

Colleagues at Mueller Associates, called Engineering Services Company before Mueller purchased the firm around 1967, said Mueller implored aspiring engineers to get their degrees.

“He said to me, ‘You’re not going to get anywhere in this business, including here, unless you get your degree and become a registered professional,’” said Gene Nerf, 78, who met Mueller at 19 years old and went on to lead the company. “He held true on that.”

As a father, Paul Mueller said, he was present but occupied with work, school and providing for the family. He managed to take them to Sunday school every week and on vacation every year.

“He wasn’t taking me to baseball practice twice a week or anything like that,” Paul Mueller said. “He was an incredible role model to me. I looked up to him. He provided very nicely for our family. We always had what we needed.”

At work, he embraced innovation and emerging technologies, according to a statement from Mueller Associates announcing his death. Mueller had a good eye for talent, put clients first and helped the company establish long-term relationships with institutions like the Baltimore Museum of Art, the Smithsonian Institution and Northrop Grumman.

Nerf said Mueller preferred high-profile jobs like museums or cutting-edge academic facilities rather than cookie-cutter shopping centers or housing developments. He led projects at The Lyric theater in Baltimore, as well as the Washington National Cathedral and North Arundel Hospital in Glen Burnie, which is now the University of Maryland Baltimore Washington Medical Center.

“If you’re working in a museum, lab or performing arts center, the engineering challenges are bigger — you could be more innovative,” Nerf said. “He liked that kind of challenge.”

Mueller recruited Bob Marino, current president and CEO of Mueller Associates, right out of Pennsylvania State University. At the mechanical, electrical and plumbing engineering firm, Marino said, Mueller was ahead of the curve in terms of using “cutting-edge technology” and energy-efficient mechanisms. He said Mueller put solar panels on the White House.

Under Mueller’s leadership, the company transformed from a four-person, one-room operation to a bustling business. Other proj-

ects included the University of Baltimore’s Angelos Law Center, The Baltimore Sun’s former printing press facility on North Calvert Street, the Maryland Historical Society and a major renovation for Baltimore’s Enoch Pratt Free Library, according to Marino and Nerf.

“The way he just approached problems and tackled challenges,” Marino said. “He always wanted to be at the forefront of innovation.”

Having worked with two engineering firms and the State of Maryland before Mueller Associates, he retired in 1994, but stayed involved with the company. Marino said his portrait hangs in the business’ Linthicum lobby and his principles still guide the firm.

Mueller liked wowing clients over meals, where you could count on him to order one of his beloved Manhattans, Paul Mueller and Nerf said.

Outside work, Mueller relished religion and swam competitively.

He was an active member at Emmanuel Lutheran Church, Baltimore, for 46 years,

at St. Peter’s Lutheran Church, Ocean City, for 15 years, and Bethany Lutheran Church, Salisbury, for eight years, according to his family. Paul Mueller said his father regularly used his engineering skills to help the churches.

Having swum for Poly in high school, he later joined swim teams at the Meadowbrook Swim Club and swam with the Maryland Masters and the “Senior Sharks” in Ocean Pines.

“He was an avid swimmer right up until close to his end of days,” Paul

Mueller said, adding his father would sometimes mention when he came home with a medal. “He was a competitive person.”

His second wife was Margaret Etzel of Bishopville, with whom he had two more children. Their marriage and Mueller’s third ended in divorce.

Even with eight children, he found a way to keep in touch, Paul Mueller said. “He was always available and I think he spoke with all of us on a regular basis and he was always willing to give thoughtful guidance on any subject to the extent that he could.”

Paul Mueller said you could always find his father, a skilled craftsman, fixing things around the house. In fact, he built his home in Bishopville. He lived there in the 1990s.

After spending winters in Florida for a decade with his fiancée Nancy Hanna, of Wilmington, Delaware, the couple moved to Pompano Beach permanently in 2017. He frequented the local American Legion and enjoyed meals at the oceanfront restaurant Sea Watch, according to the family.

He kept tabs on his former firm until his death. His legacy in engineering persists.

“I loved the guy,” Nerf said. “I think he really contributed to the engineering profession. I’m proud to have had the opportunity to work beside him and be his partner.”

He is survived by seven of his eight children: Paul Mueller, Richard Paul Mueller Jr. of Madison, New Hampshire, LeeAnn Morin of Catonsville, David Mueller of Roanoke, Virginia, Carol Garvey of Christiansburg, Virginia, John Mueller of Olympia, Washington, and Peter Mueller of Bishopville.

Also surviving him are his three ex-wives, his fiancée and companion of 15 years, seven grandchildren and seven great-grandchildren.

He was preceded in death by his older brother, Harry C. Mueller Sr., his daughter Maria Mueller, and his grandson, Brian Garvey.

A viewing was held Sunday at the Sterling-Ashton-Schwab-Witzke Funeral Home in Catonsville. There will be a memorial service at Emmanuel Lutheran Church at 929 Ingleside Ave. in Catonsville on Monday at 11 a.m., followed by interment at Lorraine Park Cemetery in Woodlawn.



Richard Paul “Dick” Mueller led projects at The Lyric theater in Baltimore, as well as the Washington National Cathedral.

Even after his retirement, Richard Mueller had remained interested in the firm’s work, staying in contact with long-time employees and following its continued growth. “He was very proud that the firm continued to operate under his name,” said Marino. “He always had a kind word, and was very encouraging. We will certainly miss him.”

The memorial service was held on October 4, 2021, at Emmanuel Lutheran Church in Catonsville, Maryland, where Mueller had worshipped for nearly half a century. Colleagues from throughout his career attended, along with his extended family. Gene Nerf, who had worked beside Richard Mueller for almost three decades, summed up the feelings of many: “I loved the guy. I think he really contributed to the engineering profession. I’m proud to have had the opportunity to work beside him and be his partner.”

As Mueller Associates mourned its founder, the firm also recognized that his greatest legacy was not in any single building or client relationship, but in the culture he had created: challenging work, technical excellence, professional development and, above all, integrity in client service. Those values had survived leadership transitions, technological changes, and shifts in the marketplace, because Richard Mueller had built his firm upon principles, rather than personalities. His name would remain on the door, but, more importantly, his philosophy would continue to guide the engineers who carried on his work.

Carrying the Name Forward

Even as the firm dealt with the loss of its founder, Mueller Associates was executing a carefully planned leadership transition designed to maintain continuity. On November 18, 2021—just two months after Richard Mueller’s passing—the firm announced that Todd Garing would become the firm’s president on January 1, 2022. Bob Marino, who had led Mueller Associates since 2006, would remain as chairman of the board. It was a transition years in the making.

Richard Mueller’s obituary ran in The Baltimore Sun on October 4, 2021—the same day colleagues and family gathered for his memorial service in Catonsville, Maryland.



Todd Garing reviews project drawings at Mueller's Edgewood office. Three decades coordinating the firm's most complex assignments preceded his appointment as president in January 2022.

For Garing, the weight of that moment was considerable. He had known Richard Mueller, worked on projects that reflected the founder's values, and learned from the generations of engineers—Gene Nerf, Bob Marino, and others—who had absorbed Richard Mueller's approach firsthand. Now, just weeks after Richard Mueller's passing, Garing would carry that legacy forward into an uncertain future shaped by climate concerns, technological change, and evolving client expectations. The responsibility was not just to maintain what had been built, but to ensure that it could adapt and endure.

The ASHRAE Connection

Garing joined Mueller Associates in 1993, after graduating from Penn State University with a degree in Architectural Engineering with a Mechanical Engineering focus. However,

unlike some young engineers starting their careers, Garing brought hands-on knowledge from years spent working in his family's mechanical-contracting business. From the age of 12, he had spent summers and school breaks working for his father, and had gained considerable practical experience by the time he finished college. Although his father had worked on a few design-build projects, Todd found himself more interested in design than construction.

The connection to Mueller Associates came through the same professional networks that had sustained the firm since Richard Mueller's earliest days. Garing's father was deeply involved in ASHRAE, as was Gary Johnson, a principal at Mueller in the early 1990s. The two had known each other for more than a decade through regional ASHRAE meetings, crossing paths regularly at conferences and gatherings. When Todd's graduation approached, his father

made a consequential, but straightforward suggestion: “You really should talk to Gary.”

Before graduating, Garing met Johnson at an ASHRAE conference in Chicago—an encounter that initiated the connection. Then came the pivotal moment: Gene Nerf and Bob Marino traveled to Penn State for an interview that would shape the firm’s future in ways none of them could have anticipated. “The presentation that Bob and Gene put on was exciting,” Garing remembered. “They talked about institutional and cultural projects on higher-education campuses. It was interesting work.” There was also the practical matter of location: Garing liked to sail, and the idea of being near the Chesapeake Bay held its own appeal. He also had a sister living in nearby Rockville, Maryland.

Three Decades of Complex Assignments

Over the course of three decades, Garing tackled the firm’s most challenging assignments. He led efforts to modernize the Smithsonian Institution’s National Air and Space Museum: a project that ultimately spanned more than a decade, and involved a complete transformation of one of the world’s most-visited museums, while protecting irreplaceable collections and maintaining public access.

Garing also oversaw the historically sensitive restoration of the National Academy of Sciences headquarters, where Mueller’s team achieved LEED Gold certification, preserved an architectural masterpiece, and integrated cutting-edge sustainable systems. Similarly, renovation of the Enoch Pratt Free Library demonstrated Garing’s ability to manage the complexities involved in updating occupied landmark buildings, ensuring that library services continued while building systems were fully modernized behind the scenes.

Beyond these signature projects, Garing managed large-scale work for virtually every institution within Maryland’s university system, as well as for George Mason University, Virginia Commonwealth University, and Virginia Tech. His reputation extended across the region’s academic and cultural communities—built not just upon technical competence, but upon the trust that comes from consistently delivering on commitments. Architects, building owners, and facility managers had learned that Garing’s involvement meant projects would be thoroughly understood, carefully coordinated, and expertly executed.

Professional recognition followed. Garing was widely published on building-system trends and innovations, particularly in sustainable design and high-performance buildings. He gave presentations at numerous industry conferences, sharing insights from Mueller’s most challenging projects. His proficiency in managing complex assignments also helped the firm garner multiple regional and national awards.

Yet, for all his technical accomplishments, Garing’s impact extended beyond project delivery. “Throughout his career at Mueller, Todd has served as a mentor to aspiring engineers,” Marino said. “I’ve witnessed Todd’s impact on our staff firsthand. I know that his dedication to advancing engineering doesn’t end with the building’s completion. Todd inspires and challenges the next generation of engineering leaders to design a more sustainable environment that enhances the greater good within our communities.”

This emphasis on mentorship reflected Richard Mueller’s most important legacy. The founder understood that a firm’s long-term success depended upon developing talent from within, and upon creating an environment in which young engineers could grow into leaders who would carry forward

TO OUR CLIENTS AND COLLEAGUES

Every issue of *Momentum* is special to us. From large, high-profile projects, such as major museums and libraries to new campus buildings and performing arts centers, our engineers take tremendous pride in our contributions to improving the built environment. In this issue, we place a spotlight on several of our smaller yet more unique projects, from a lighthouse and historic crypt to a natatorium and minor renovations at private museums.

While larger projects may have bigger budgets, smaller-scale projects can be just as complex and require careful coordination with multidiscipline design and construction teams. Limited spaces may require creative decision-making in terms of design solutions, and modest budgets generally mean little margin for “surprises.” Efficiency, ease-of-maintenance, sustainability, and reliable performance are always important, no matter the size of the project.

At Mueller, we approach our projects—regardless of square footage or budget—with equal enthusiasm and rigor. Our engineers recognize the value and impact our designs bring to communities, whether supporting visitors to a historic lighthouse, students worshipping in a historic chapel or studying for an exam in the campus library, or patrons admiring the work of local artists and artisans. We hope you enjoy reading about a few of these fascinating examples.



As we begin a new year, I am honored to now serve as president of Mueller Associates. I look forward to working with our chairman, Bob Marino, our talented staff, and all of you to make this year a success. Please stay in touch.

Sincerely,

A handwritten signature in black ink that reads "Todd J. Garing".

Todd Garing, PE, LEED AP BD+C
President

Garing's first message as president appeared in the spring 2022 edition of Momentum, the firm's newsletter, a statement of continuity addressed to clients and colleagues.

the firm's values and standards. Gene Nerf had benefited from Richard Mueller's mentorship and had mentored Bob Marino who, in turn, had helped develop Todd Garing and countless other engineers who have become leaders within the firm. The pattern was intentional: a deliberate cultivation of institutional knowledge and cultural continuity that no succession plan document could capture, but that every successful transition reinforced.

A First Message

In his first message to clients and colleagues as president, published in the Spring 2022 edition of the company newsletter *Momentum*, Garing articulated an approach that would have resonated with Richard Mueller. Reflecting upon a diverse array of projects, he wrote about the firm's

commitment to excellence, regardless of project scale. “While larger projects may have bigger budgets, smaller-scale projects can be just as complex and require careful coordination with multidiscipline design and construction teams,” Garing said. The message concluded with an acknowledgment of the transition, and a commitment to continuity: “As we begin a new year, I am honored to serve as president of Mueller Associates. I look forward to working with our chairman, Bob Marino, our talented staff, and all of you to make this year a success.”

What that leadership meant in practice would become clear in the projects that followed: assignments that demonstrated both the firm's capacity to master new challenges, and its ability to steward decades-long relationships across generations of engineers.



BUILDING INTIMACY AT THE BELTWAY'S EDGE: CAPITAL ONE HALL

For 50 years, the Kennedy Center for the Performing Arts had stood as the Washington area's premier performing arts venue, overlooking the Potomac River from its iconic white marble terraces. Then, in the fall of 2021, another white marble building rose 15 miles to the west, at the intersection of the Capital Beltway and Dulles Toll Road. **Capital One Hall** represented an audacious vision: transforming Tysons, Virginia—long dismissed as a soulless “edge city” of office towers and shopping malls—into a cultural destination capable of hosting world-class performances.

The 149,000-square-foot Capital One Hall houses three distinct performance spaces: the Main Theater, a 1,600-seat venue designed for major productions and concerts;

the Vault, a 225-seat black box theater; and the Atrium, an 825-person flexible event space. Capital One Hall quickly established itself as a premier venue for Broadway productions, concert tours, and comedy shows. Yet the building's success ultimately depended upon engineering systems that remain invisible: systems that can deliver perfect acoustics, optimal comfort, and sustainable operation, while remaining entirely unnoticed by the audience.

A Box Within a Box

The design of Capital One Hall's performance spaces presented an immediate obstacle that would influence every aspect of Mueller's engineering approach. The building

was nestled amid intense urban activity. A parking garage and busy loading dock at the lowest levels served a supermarket at street level, and the building was surrounded by office towers and retail spaces. At its apex was a rooftop park called The Perch, with a beer garden and amphitheater. Nearby, Metro trains moved through the Silver Line station. Heavy vibrations from all directions threatened to compromise the acoustical integrity needed for world-class performances.

The design team—HGA as architect, Thornton Tomasetti as structural engineer, and Mueller Associates as mechanical, electrical, plumbing, and fire protection engineers—faced a seemingly impossible challenge: creating an acoustical sanctuary amid urban chaos. The team’s solution was audacious: build the performance spaces within a concrete structure, separated from the surrounding building. Large rubber isolation devices would absorb shocks and minimize vibrations, creating what the team called a “box within a box.” Yet this ingenious structural solution posed a significant challenge for Mueller’s engineers: how to route building systems into and through the inner box without compromising its acoustical integrity.

Clark Davenport, Mueller’s lead mechanical engineer on the project, recognized the delicacy required to address these obstacles. “This Hall is a concrete box that is isolated from the rest of the building structure around it,” he explained. “It has large rubber devices that isolate it from vibration, and prevent a hard connection to the surrounding building. The reason for that is to make sure the space stays very quiet, and isn’t affected by other operations that could cause vibration in the theater.”

The implications for the building system’s design were profound. Every duct, every pipe, every electrical conduit that

penetrated the acoustical envelope represented a potential breach. And each breach could become a potential pathway for sound and vibration to enter the sacred space where audiences would sit in darkness, listening for the quietest passages of music, or the most intimate moments of theatrical performance.

“All systems within and serving this space had to meet these requirements,” said Davenport. “We couldn’t have ductwork penetrating walls or floor slabs, except in specific locations. To enter the space, careful coordination was required in certain wall zones, and stringent requirements applied to the penetration configurations. We needed to carefully and strictly size any elements passing through walls, ceilings, or floors.”

Even the methods for sealing penetrations required specialized approaches rarely used in conventional buildings. “How those elements were sealed around penetrations was also very acoustically sensitive, and required methods and details that aren’t really commonly used in most types of facilities,” Davenport explained. “It was very unique in terms of meeting those acoustical-separation requirements. The box-within-the-box was the sacred principle that we couldn’t violate, unless we followed all the criteria to get in and out of the space with our utilities and our systems.”

Scott Cryer, a principal with HGA who oversees the firm’s cultural practice, appreciated Mueller’s meticulous approach to this challenge. “We needed to coordinate closely on the penetration points, and keep those to as few as possible,” Cryer observed. “We didn’t want the box to become Swiss cheese. Mueller’s engineering team did an exceptional job of reducing the number of penetrations to help preserve the structure’s integrity, which supported the overall acoustical quality in the theaters.”

The Art of Invisible Comfort

Beyond minimizing penetrations through the acoustical envelope, Mueller's engineers faced another critical challenge: designing systems that could condition the air for a 1,600-seat theater, without creating any perceptible noise or discomfort. The solution required innovative approaches to both air distribution and system operation, reflecting decades of accumulated expertise.

For the Main Theater, Mueller designed displacement-ventilation systems featuring extremely low air-discharge velocities. The system uses underfloor ductwork to supply air to pressurized plenums beneath the seating areas, both on the main orchestra level and in the balconies. "That air is then transferred through round diffusers in the floor, or through horizontal slot openings in the face of the seating tiers, at very low velocities," said Davenport. "A primary benefit of using that kind of system is very low noise-generation from the low-velocity ductwork and air devices."

The displacement-ventilation approach differs fundamentally from conventional HVAC systems, in both its operation and its impact on occupant comfort. Rather than delivering significantly cooled or heated air from overhead diffusers, the system supplies air at temperatures only slightly different from the desired temperature for the space. "You don't hear the system, and you don't really feel it either," noted Davenport. "The air is supplied at a very low velocity. It's slowly rising up from the floor. You don't want occupants to feel a cold breeze on their ankles."

The physics of the system exploits natural convection patterns within the theater. "It allows that air to sweep over occupants at their level of seating," Davenport explained. "It captures the heat produced by the patrons; that heat then

risks with supplied air, up into the higher part of the space, where it is returned to the system. This type of system is very efficient and very quiet."

Adam Fry, Mueller's vice president and project manager for the Capital One Hall project, described another dimension of the engineering challenge: integration with systems serving the entire Capital One Center development. "Capital One Hall has its own electrical service, but we needed to tie in with other central systems serving the hotel, parking garage, and retail," he said. "We tied into the central bank of generators for emergency power, and the central fire-alarm system serving the entire block."

Coordination extended beyond the building itself, requiring Mueller's team to think comprehensively about how the Hall's systems interfaced with the broader campus infrastructure. "We focused on the intricacies of detailing the systems to work within the box structure, but we also needed to think beyond the hall itself," Davenport added. "We coordinated our systems with those in other development blocks on the headquarters campus. A major focus from start to finish was carefully integrating the systems both within the building and beyond."

Efficiency Behind the Scenes

Although acoustical performance influenced many design choices, Capital One Hall also reflected Mueller's commitment to sustainable design. The building earned LEED Gold certification, and achieved energy savings of more than 27%, compared to typical code-compliant structures.

"One of the biggest things we did is energy recovery within each of the air-handling units, serving not only the actual performance space but the building itself," said Daven-



The 1,600-seat Main Theater at Capital One Hall. Air rises through plenums beneath the seating and slots in the tiers' faces at near-silent velocities, displacement ventilation that audiences register only as comfort.

port. “We use enthalpy wheels in all the units to recover exhausted heat, and reuse it to preheat or pre-cool the outside air coming into the building for ventilation.”

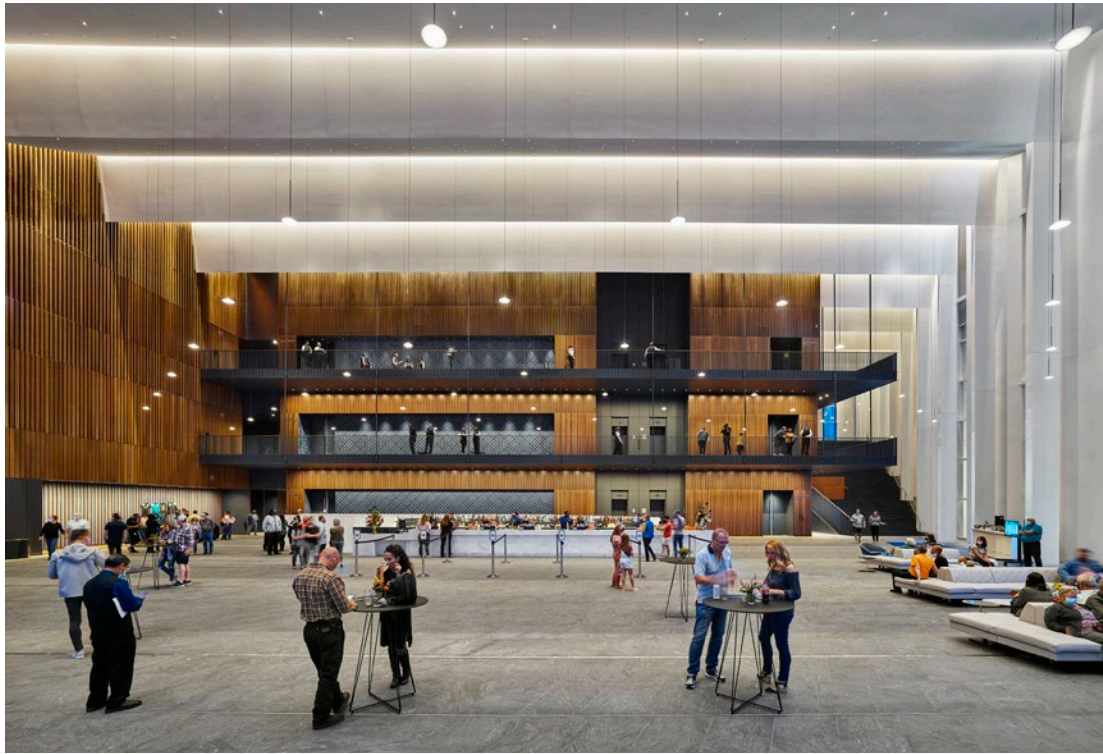
The project also integrated a demand-controlled ventilation strategy, especially suitable for the fluctuating occupancy patterns of a performing arts center. “In a building like this, many spaces aren’t always occupied,” Davenport pointed out. “If you have a sold-out show on Saturday or Sunday, it’s 1,600 people sitting in the Hall. But on Monday morning, there’s nobody there. The system might still need to run to maintain a comfortable level in the building, especially if you have equipment, like a piano, that requires the space to be kept at a specific temperature. But you don’t always have to ventilate that space.” This approach allowed Mueller to condition spaces and maintain appropriate temperature

and humidity for sensitive equipment and finishes, while minimizing the energy required to treat outside air during periods of low or no occupancy.

When Engineering Disappears

For Davenport, the true measure of Capital One Hall’s engineering success came not from calculations or commissioning reports, but from a personal moment about two years after the building opened.

“I came to a concert with my wife around Christmastime,” he recalled. “It was my first time there, not in the capacity of reviewing the conditions of the project or punching out the project. It was my first time there as a spectator attending an event.”



The 825-person Atrium hosts a reception. Demand-controlled ventilation matches conditioning to occupancy: full treatment for a packed event, minimal energy when the space sits empty the next morning.

The experience brought a mix of anticipation and nervousness. “I was pretty excited to be there, and I was just a little bit nervous about it because I was going to experience what everybody else does, and experience what the systems in the building are doing. I hoped I wouldn’t notice them at all.”

As the performance began and the hall grew quiet, Davenport found himself listening intently for any indication of the mechanical systems he had spent years designing. “I remember taking my seat and, as the show was starting, it got really quiet. I listened for any fan noise or any air movement. And I couldn’t hear anything. I was pleased by that, because it meant that the system was working as intended. I was very comfortable too. It was a nice temperature, so it was exactly as I was hoping it would be.”

That moment brought Davenport back to the fundamental purpose of his work: not the technical challenge or professional recognition, but the human experience that engineering systems make possible. “One thing that I’ve really enjoyed in working on this project, and many others, is when I know I’m working on a building that’s going to affect people positively,” he said. “Attending a concert at Capital One Hall, I really enjoyed it the same way that anybody else buying a ticket and coming to a concert would. It allowed me to have firsthand experience of what the project I worked on has become, and its success.”

The ensuing recognition had been significant. Scott Cryer from HGA offered high praise for the engineering team’s work. “Mueller is an excellent fit for projects that require



Josh Groban christened Capital One Hall as its first-ever performer on October 1, 2021, closing his concert a cappella, an unamplified test that the room carried the quietest notes to every seat.

sensitive MEP design,” he said. “They understand the need to route and detail systems to reduce vibrations and noise that can be disruptive. They work within the architectural pathways, and avoid long runs for the most cost-effective and efficient design.”

When singer Josh Groban performed at the grand opening, he praised the acoustics before ending the concert with an a cappella song that showcased the Hall’s ability to carry even the quietest performances with clarity and intimacy.

As audiences continue to fill Capital One Hall for Broadway and comedy shows, concerts, and community events, few think about the pressurized plenums beneath their feet, the enthalpy wheels recovering energy in the mechanical rooms,

or the carefully sealed penetrations through the acoustical box. Yet those invisible systems—designed, coordinated, and refined by Mueller’s engineers over years of focused effort—make every performance possible. It is engineering exactly as it should be: essential, sophisticated, and entirely transparent to those it served.



TWO GENERATIONS, SAME BUILDING: THE NATIONAL MUSEUM OF WOMEN IN THE ARTS

If Capital One Hall demonstrated Mueller's capacity to master new challenges, the **National Museum of Women in the Arts** (NMWA) revealed something equally important: its ability to steward decades-long relationships across generations of engineers, while embracing evolution.

In late 2023, NMWA reopened after a comprehensive multi-year renovation that had transformed the historic building at 1250 New York Avenue in Northwest Washington, D.C. For Mueller Associates, the project represented a full-circle moment: the same institution where Gene Nerf and a young Bob Marino had engineered building systems nearly four decades earlier was now being led by a new generation of engineers at Mueller: Rebecca Fischer and Karen Schulte.

The wedge-shaped Classical Revival building had lived many lives. Designed by renowned architect Waddy Butler Wood, it had opened in 1908 as an ornate Masonic Temple. By 1916, the first floor had been converted into film theater, including showing kung-fu movies in the 1960s. When Wilhelmina and Wallace Holladay discovered it in the early 1980s, they saw what others had missed: a historic architectural treasure just three blocks from the White House, with stunning spaces that could become galleries, an event hall, and support facilities for the museum they had envisioned.

A Young Engineer's Milestone

The ambitious 1980s transformation of the Masonic Temple into a museum required a design team with deep experience in both historic preservation and the carefully controlled environments required to protect museum collections. The Holladays turned to Keyes Condon Florance (later acquired by SmithGroup), museum design specialist David Scott, and Mueller Associates to complete the complex renovation.

For Mueller, the project was both a prestigious assignment and a training ground for future leaders. Gene Nerf led the mechanical, electrical, and plumbing engineering team, working closely with Bob Marino, who had recently joined the firm. It was the kind of challenging, culturally significant project that Richard Mueller always pursued: one that would demand technical excellence, while providing something meaningful to the community.

"It was a prestigious, challenging job—we were engineering all new systems within a landmark historic building," Nerf recalled of the 1980s renovation. "The systems had to maintain precise temperature and humidity control, and they also had to be very quiet." These requirements reflected the dual nature of museum engineering: the systems had to create optimal conditions for preserving works of art, while remaining imperceptible to visitors experiencing those same works.

The project's technical challenges emerged immediately. The roof seemed the logical location for the two air-handling units, but the existing framing could not support their weight. Because reframing proved prohibitively expensive, Mueller's engineers moved the units to the building's basement, along with the central plant equipment. "We had to work carefully to locate and conceal the ductwork

and piping," said Nerf. "There were many open areas and historical architectural details, as well as expansive gallery spaces that needed protection." The team's fieldwork involved extensive surveys and meticulous coordination to thread systems through the oddly shaped building, which had never housed central mechanical systems.

Museum-Quality Systems, Pre-LEED Era

Mueller's engineering approach reflected the pre-LEED era's focus on core principles of efficiency and maintainability, rather than certification frameworks. "We were focused on engineering systems that would optimize climate control, efficiency, and maintainability in a time before LEED design strategies," said Marino. "Several temperature-control zones were necessary to meet the different uses and occupancies of the building. We developed museum-quality HVAC systems for the galleries, and a separate system for the auditorium and public areas."

Marino also recalled an interesting challenge related to the building's original purpose as a Masonic Temple designed exclusively for men. "There were no women's restrooms throughout most of the building," he noted. "Obviously, it was important to address that during the 1980s renovation." His observation serves as a reminder that adaptive reuse often requires attention to the most basic functional changes, alongside sophisticated technical systems.

As the project neared completion, one moment stood out, revealing the success of Mueller's design approach. An acoustician arrived to test the Great Hall: a space composed mostly of hard, sound-reflective surfaces that posed natural acoustical challenges. "He asked that the HVAC system be turned on so that he could gauge the amount of sound and reverberation," Marino said. "We told him that the sys-

tem was already running—it was that quiet. He was quite impressed. Gene and I were very proud of that.”

Three Decades of Stewardship

The National Museum of Women in the Arts opened to widespread acclaim in 1987, serving as an outstanding demonstration of thoughtful historic preservation and adaptive reuse. The Great Hall on the first floor, featuring marble sourced from Turkish quarries and an impressive staircase, became one of Washington’s most refined venues for special events. Galleries on the second and third floors displayed the Museum’s expanding collection, while a library and research center occupied the fourth floor. The fifth floor was redesigned to include an auditorium, with offices on the fifth and sixth floors.

From the beginning, NMWA administrators had diligently maintained the building. Yet after nearly three decades, even well-maintained systems reach the end of their useful lives. By the mid-2010s, the original HVAC systems were aging, and the BAS had become outdated. The exterior envelope and roof had weathered decades of exposure, with the infiltration of air and moisture causing concern. Other systems needed updating to meet contemporary standards. The Museum’s collection had grown significantly, and educational programs had expanded, requiring reevaluation of storage, exhibition spaces, and support facilities.

In 2015, NMWA selected Sandra Vicchio & Associates (SVA) to lead the development of a Facilities Preservation Plan (FPP), working with exterior-envelope specialists CVM, and Mueller Associates for mechanical and electrical engineering services. The plan, completed in 2016, addressed functionality, collections safeguarding, energy use, and enhanced visitor experiences, while also providing

a comprehensive guide for long-term stewardship. “The Museum recognized that, after nearly three decades, it was necessary to address sustainability and the ongoing protection of its collections,” noted Sandra Vicchio, principal in charge of the planning and design process. “The needs of the Museum had also evolved. The FPP helped define the scope of the renovation, and set priorities and opportunities early. It also served as a springboard for the Museum’s fundraising campaign.”

Women Leading the Transformation

With the plan providing a clear framework, NMWA engaged SVA to lead the project, who then turned to Mueller Associates for mechanical, electrical, and plumbing engineering, and CVM as structural engineer, along with Marshall Craft Associates as associate architect. These firms became the core of the renovation project’s design team.

The scope of the Museum’s renovation involved reinforcing the exterior envelope, installing new building systems, reorganizing office and support areas, enhancing public spaces, and improving accessibility. A creative reconfiguration within the building’s existing footprint added approximately 4,500 square feet of gallery and programming space, including a new Learning Commons. SVA completely reimagined the galleries to provide maximum flexibility and an intuitive visitor experience.

The NMWA renovation carried particular significance, because women led both its design and construction. This was appropriate for the first museum in the world dedicated solely to supporting women in the arts, and a telling indicator of how the engineering profession had evolved since the 1980s. When Gene Nerf and Bob Marino designed the original systems, women engineers were still



The renovation team gathers in the unfinished performance hall. Women led both NMWA's design and construction, a measure of how far the profession had evolved since Mueller engineered this same building in the 1980s.

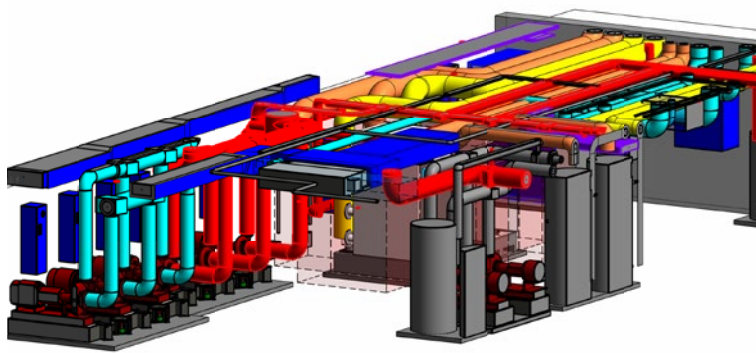
rare within the profession. Now, nearly four decades later, women were leading one of the region's most significant cultural renovations.

Rebecca Fischer, who had joined Mueller in 2004 and risen to the position of associate and project manager, led the mechanical-engineering design. Fischer had grown up fascinated by how things worked, taking apart household appliances as a child to understand their mechanisms. She pursued mechanical engineering at Penn State University, discovering that building systems offered the perfect intersection of technical challenge and tangible impact: the creation of environments in which people could learn, work, and experience art and culture.

During her more than two decades at Mueller, Fischer had established herself as one of the firm's foremost experts in

BIM and Revit, mastering the digital tools that had transformed how engineers designed and coordinated complex systems. She had also become known for her ability to navigate the particular challenges of historic renovations, where modern systems must be threaded through structures never designed to accommodate them. The NMWA project brought together both specialties in a building she found personally meaningful.

"This project represented something special for several reasons," Fischer reflected. "Working on a building where Gene and Bob had done the original systems felt like being part of a continuum—honoring their work, while bringing it forward to meet contemporary needs. And doing that for an institution dedicated to women artists, with a project team of women leading the way, felt significant in ways that went beyond the technical challenges."



A Revit model (above) maps the NMWA renovation's mechanical systems in three dimensions. Those systems are realized in the finished mechanical room (right). Digital tools unavailable in the 1980s now allowed Mueller to thread modern infrastructure through a century-old structure.



Karen Schulte, who led Mueller's plumbing design, brought a similar combination of technical expertise and personal investment to NMWA. Schulte had joined the firm in 2006, after studying at Penn State University. She had gravitated toward plumbing engineering, because it required both systematic thinking and creative problem-solving: finding pathways for water supply, drainage, and specialty systems through buildings where space was always at a premium, and constraints were always multiplying.

"I've always appreciated that plumbing engineering gets less attention than mechanical or electrical," Schulte noted, "but when it's done well, nobody notices, and when it's done poorly, everyone does. There's satisfaction in that invisibility—in knowing that the systems work so seamlessly that they disappear." For both Fischer and Schulte, the opportunity to work on NMWA represented the kind of

project that had drawn them to Mueller in the first place: technically demanding, culturally significant, and connected to the firm's larger story of institutional stewardship.

Threading Systems Through History

The updated design of mechanical systems at NMWA reflected how dramatically standards had evolved since the 1980s. "The current requirements for energy conservation are much more stringent than they were at the time of the original renovation," Fischer noted. To reduce energy consumption, Mueller added total-energy-recovery wheels in the new air-handling units, and a dedicated heat-recovery chiller to provide simultaneous heating and cooling. The design also incorporated a robust adiabatic humidification system to maintain the precise humidity levels required for the conservation of art.

The new systems included a standalone chilled-water plant for cooling and dehumidification, along with a separate hot-water boiler plant to handle the Museum's varied thermal load. A direct digital control (DDC) energy-management and automatic temperature-control system coordinated all HVAC equipment, providing the advanced monitoring and adjustment capabilities that modern museums require.

Routing Challenges Old and New

The renovation presented another round of challenges in routing ductwork through the historic structure—challenges that echoed those Gene Nerf and Bob Marino had navigated decades earlier, but with new complications. “Although we were able to use the same shafts as in the 1980s renovation to route ductwork and piping vertically,” said Fischer, “there were new elements above the ceiling that we needed to work around in our ductwork layout.”

The Museum had added a structural grid. “This grid extends throughout the galleries to provide flexibility where heavier works of art are displayed, but also limited where we could run the ductwork,” Fischer noted. Additionally, new lighting-track systems required coordination. “Several lengths of lighting track were added to the galleries. We had to coordinate with all these elements.”

The solution Mueller developed showcased innovative thinking about how mechanical systems could enhance, rather than hinder, exhibition design. “One of the really big wins in this project was the redesign of the galleries,” said Sandra Vicchio.

Mueller's team introduced linear architectural openings for return air in reveals at the bases of the gallery walls—elegant “toe-kick” details that eliminated disruptive grilles,

while maintaining clean spaces for showcasing art. Supply air was placed at the top of the walls and directed away from the works of art. The strategic use of air distribution in the cavity between exterior and interior walls allowed the team to maximize ceiling height, while maintaining effective environmental controls.

“The mechanical, electrical, and plumbing systems blend in with the surrounding architecture to minimize their visual and audible impact on the art,” said Cara Versace of Marshall Craft Associates. Fischer found particular satisfaction in how the solution honored both the historic structure and contemporary museum needs. “We were working in a building where I knew Gene and Bob had solved similar problems decades earlier,” she said. “I thought about what they had accomplished with the tools available in the 1980s—no BIM, no sophisticated energy modeling, everything coordinated through drawings and field surveys. We had better tools, but the fundamental challenge was the same: how do you make modern systems disappear into a historic building? How do you protect the architecture while serving the mission?”

Hidden Infrastructure

The plumbing engineering presented its own complex challenges. Karen Schulte oversaw a comprehensive piping-replacement project throughout the building, including under-slab systems that required extensive coordination to avoid disrupting collections storage areas. “One of the most complex aspects of the project was coordinating across disciplines to ensure that piping didn't infringe upon storage and archives,” said Schulte.

With significant portions of the basement designated off-limits, in order to protect collections, engineers had to

navigate narrow pathways to access vertical distribution routes. This constraint required creative routing and precise coordination with mechanical and electrical systems.

Schulte also appreciated the collaborative dynamic that Fischer had fostered between the engineering disciplines. “Rebecca created an environment in which we could bring up problems early, and solve them together,” said Schulte. “There was never any sense of territorial protection—it was always about finding the best solution for the building and the client, even if that meant one discipline giving up preferred routing to accommodate another’s needs.”

The electrical design, meanwhile, enhanced flexibility throughout the renovated Museum, while incorporating innovations to meet LEED Silver requirements. The building-wide lighting-control system enabled staff to adjust exhibit lighting throughout the Museum without extensive reprogramming.

“The seamless integration of new MEP systems into the iconic building was critical to the project’s success,” noted Versace. “The MEP systems were designed to work in concert with the improvements made to the historic envelope, and to protect and to preserve NMWA’s remarkable collection.”

Quiet Spaces for Engagement

The NMWA renovation extended beyond building systems, fundamentally reimagining how visitors would experience the Museum. Through thoughtful gallery reconfigurations, the design team created intuitive circulation paths that guided patrons through exhibitions, while providing clear sightlines that enhanced engagement with works of art. “We’ve created an experience for visitors more in the man-



It’s challenging to put big ducts in a historic building, and we couldn’t reduce the ceiling height—we needed large, clean vertical spaces for the display of art. We carefully considered the distribution of the systems, and created a vertical chase between the exterior masonry and the interior walls to run the ductwork. With a minimal loss of square footage, we were able to maintain the required ceiling heights.

Sandra Vicchio

ner of a grand art museum,” Vicchio said. “The galleries have a very quiet feel to them, enabling visitors to engage more effectively with the art. The reconfiguration of the gallery spaces allows visitors to see what’s ahead, and to visualize their journey as they navigate the exhibitions.”

The journey begins in the Great Hall—an iconic space that has welcomed visitors since 1987—and continues through reconfigured galleries to the fourth-floor library and new Learning Commons. The revitalized spaces throughout the building have enabled NMWA to expand educational and outreach programs, while better protecting and displaying its collection of more than 6,000 paintings, sculptures, and other works. The refurbished fifth-floor performance hall, with new finishes, ceiling, and theater systems, seats more



A great example of the seamless integration between the architecture and the MEP systems is the gallery walls. The base of each gallery wall incorporates both a return-air slot and a wiremold raceway, hidden within a two-inch reveal. The return air slot eliminates the need for wall-mounted return air grilles, and the raceway provides greater flexibility for electronic displays. These two strategies helped provide a large continuous display surface for art, without sacrificing functionality.

Cara Versace

than 180 patrons for lectures and performances. Optimized spaces for staff and support functions have improved operational efficiency, while enhanced accessibility throughout the building has reinforced the Museum's commitment to welcoming all visitors.

For Fischer, the opportunity to walk through the completed galleries carried particular meaning. "I thought about the 1980s renovation, and imagined Gene and Bob walking through for the first time, seeing how their systems had been concealed, checking that everything worked as intended. Now I was doing the same thing, decades later, in the same building. The technology had changed, the standards had evolved, but the fundamental satisfaction was identical: creating an environment where art could be experienced

and preserved, and where the engineering disappeared so completely that visitors could focus entirely on what they came to see."

Continuity Through Change

For Todd Garing, the NMWA project represented more than just another successful renovation; it embodied the continuity of values and expertise that had sustained Mueller Associates through leadership transitions and technological evolution. The same institution in which Gene Nerf had mentored Bob Marino in the 1980s had now provided opportunities for Rebecca Fischer, Karen Schulte, and others to demonstrate their expertise on a project of cultural significance. The mentorship chain that Richard Mueller had initiated continued unbroken, adapting to new technologies and contemporary expectations, while maintaining the core principles of excellent service.

The contrast between the 1980s renovation and the 2023 transformation illustrated how dramatically expectations related to building technologies and sustainability had advanced. Energy-recovery systems, sophisticated building automation, advanced humidity control, and integrated digital-coordination tools had all emerged since Nerf and Marino threaded the original systems through the historic structure. Yet the fundamental approach remained the same: understand the client's mission, coordinate meticulously with historic-preservation requirements, create museum-quality environmental controls, and ensure that building systems enhance rather than compromise the visitor experience.

What had changed significantly since the 1980s was who was leading the work. The fact that women engineers had taken the lead on renovating a museum dedicated to women



Reconfigured galleries give visitors clear sight-lines and a quiet feel, letting them take in the art while the systems conditioning the space stay out of view.

artists was not merely symbolic; it reflected a genuine transformation within the profession. When Gene Nerf and Bob Marino worked on the original project to address the lack of women's restrooms throughout most of the building, women engineers were still rarities in the field. Now they were leading major cultural projects, bringing the same technical expertise and dedication to invisible excellence that had always characterized Mueller's work.

Recognition and Reflection

When NMWA reopened in October 2023, *The Washington Post*, *The New York Times*, NPR, *Vanity Fair*, and PBS all profiled the transformation. It was recognition that extended beyond the museum community to general audiences interested in architecture, preservation, cultural institutions,

and women artists. The coverage highlighted not just the building's physical renewal, but also its enhanced capacity to fulfill the Holladays' founding vision of championing women artists.

Yet for those who understood the fuller story, the renovation represented something else as well: evidence that the culture Richard Mueller had created—challenging work, technical excellence, professional development, and integrity in client service—could not only survive leadership transitions, but could also evolve to reflect contemporary values while maintaining timeless standards. Gene Nerf had mentored Bob Marino in this same building four decades earlier. Bob Marino had mentored Todd Garing across dozens of projects over two decades. Garing had fostered an environment in which Rebecca Fischer and Karen Schulte



The Great Hall, all marble and hard reflective stone. When an acoustician asked that the HVAC be switched on to test the space, Mueller's engineers told him it was already running; it was that quiet.

”

Richard Mueller built this firm upon principles rather than personalities. What I've learned is that those principles—pursuing challenging work, maintaining technical excellence, developing people, serving clients with integrity—those don't just survive transitions; they enable them.

When Rebecca and Karen led the NMWA renovation, they weren't trying to work the way Gene and Bob did in the 1980s. They brought their own expertise, their own approaches, their own perspectives. But they were guided by the same fundamental values. That continuity is what allows evolution. That's what Richard Mueller understood when he built this firm, and that's what we have to protect as we move forward.

Todd Garing

could lead transformative work. The chain extended all the way back to Richard Mueller's founding vision, and forward into a future that those early leaders could not have imagined, but would certainly have recognized.

The firm that bore Richard Mueller's name would continue to evolve. New technologies would emerge, sustainability standards would become more demanding, client expectations would shift, and new generations of engineers would bring fresh perspectives to age-old challenges.



Across two generations of work at the National Museum of Women in the Arts, Mueller has integrated quiet and efficient building systems into the historic structure—protecting the collections, while allowing the art and architecture to remain the focus.

But the culture that Mueller had created—refined through generations of leadership and proven across thousands of projects—would guide every assignment, every client relationship, every young engineer learning the craft from those who came before. That continuity, more than any single project or technological advancement, represented Richard Mueller's enduring legacy and the way forward for Mueller Associates.



CHAPTER 12

A Partnership to Preserve America's Treasures

For nearly 50 years, Mueller Associates has maintained one of the most remarkable client relationships in the engineering profession: an ongoing partnership with the Smithsonian Institution, spanning more than 100 projects, and encompassing work in every Smithsonian building on Washington, D.C.'s National Mall—and beyond.

From the modernization of the National Air and Space Museum to a thoughtful renewal of the National Zoo's Bird House, and from vast collections and storage facilities to the new Bezos Learning Center, Mueller's engineers have worked on projects of every scale and complexity. This enduring relationship reflects not just technical expertise, but also a deep institutional understanding of the unique challenges inherent in preserving and displaying the nation's cultural heritage.

Mueller Associates' relationship with the Smithsonian began in 1978, with HVAC renovations at the National Portrait Gallery. In the 1980s and 1990s, the firm further established its expertise across the Smithsonian's diverse portfolio. This included environmental controls and electrical upgrades at the Cooper-Hewitt Museum and at the American Art Museum's Lincoln Gallery; master planning for the Arts and Industries Building and the National Museum of Natural



The Old Patent Office Building, shared by the National Portrait Gallery and the Smithsonian American Art Museum. It was here, with a 1978 HVAC renovation at the Portrait Gallery, that Mueller's partnership with the Smithsonian began.

History; preservation work at the Paul E. Garber facility; engineering for the National Museum of American History's *Engines of Change* exhibition; and an HVAC analysis at the Renwick Gallery. It also comprised the third-floor renovation at the National Air and Space Museum; the North Tower expansion at the Castle; ventilation studies for the National Museum of Natural History's Osteoprep lab; and dozens of other projects. Spanning museums, research facilities, and collections spaces, these early commissions demonstrated Mueller's ability to work across the full spectrum of Smithsonian facilities.

By the early 2000s, Mueller had become a trusted engineering partner for some of the Smithsonian's most complex and

sensitive projects: work that required understanding not just MEP systems, but also the delicate psychrometrics of artifact preservation, the behavioral needs of zoo animals, and the cultural significance of the stories being told.

The projects that follow—presented chronologically from 2008 to the present—represent some of the most technically sophisticated and culturally significant work in the 60-year history of Mueller Associates.



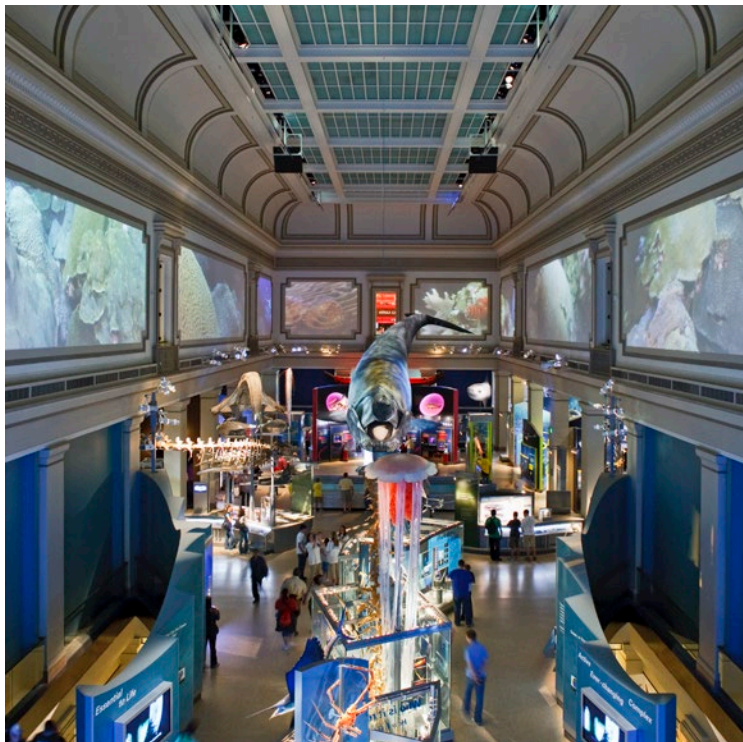
BRINGING THE OCEAN TO THE NATIONAL MALL: SANT OCEAN HALL

When the Smithsonian's National Museum of Natural History opened to the public in 1911, it was one of the most striking architectural landmarks on the National Mall. Designed by the Washington firm Hornblower & Marshall—in collaboration with the renowned Charles Follen McKim of New York-based McKim, Mead & White—the nearly one-million-square-foot Beaux-Arts building was part of the vision espoused in the McMillan Plan: an unofficial proposal from the early years of the 20th century, aimed at transforming Washington into a city filled with monumental Neoclassical structures.

The building's innovative steel-frame construction supported three main halls, each 116 feet wide and equipped

with skylights. It had no permanent interior walls, allowing greater flexibility for exhibitions. At its center was an octagonal rotunda, 81 feet in diameter, topped by a 75-foot dome that soared 165 feet.

For nearly a century, one of these three grand central halls—located directly behind the rotunda and opposite the National Mall—had served various exhibition purposes. Focused initially on ethnology—the study of human cultures—the space had been modified multiple times throughout the 20th century to host different exhibitions. By the early 2000s, layers of alterations had accumulated, concealing the hall's high ceilings and architectural details, separating it from other parts of the Museum, and obscuring the



The 45-foot North Atlantic right whale replica (left) presides over Sant Ocean Hall, restored to the grand spatial volume the original architects had intended. Floor-to-ceiling high-definition projections (right) immerse visitors in the ocean environment—both dependent on the precise climate control Mueller concealed within the century-old structure.

grand spatial layout designed by the original architects. The Smithsonian recognized that this impressive space deserved a restoration that would honor its architectural heritage. In 2008, when **Sant Ocean Hall** opened to the public, the 23,000 square feet were transformed into a comprehensive ocean exhibition.

Invisible Infrastructure

Mueller Associates, collaborating with Quinn Evans as the project's architect, faced the complex task of replacing MEP systems dating back to the 1960s. The integration of new building systems into the architectural fabric required innovative solutions that made the infrastructure nearly invisible. Mueller's engineering team oversaw the installation of four new variable-air-volume air-conditioning units, carefully

integrating them into the historic structure. Air ducts, conduits, and sprinkler piping dropped into each bay from the floor above, preventing horizontal elements from crossing the galleries' character-defining ceilings. Mueller's engineers also designed advanced lighting controls featuring an ETC dimming system with Ethernet and DMX capabilities, as well as emergency-power lighting-control devices. This infrastructure supports both exhibition lighting and specimen protection during power outages.

When Sant Ocean Hall opened, it quickly became one of the Museum's most popular destinations. The ocean had come to the National Mall, and Mueller's engineering had helped to keep it there.



TRANSFORMING A BEAUX-ARTS LANDMARK: THE WILLIAM H. GROSS STAMP GALLERY

One of Washington, D.C.'s most elegant Beaux-Arts buildings stands where Massachusetts Avenue meets North Capitol Street: the historic Washington City Post Office, designed by the Chicago-based firm D.H. Burnham & Company. Burnham—who also designed nearby Union Station, which opened in 1907—created the Post Office as a visual and practical complement to both the train station and the U.S. Capitol.

For 72 years, from its opening in 1914 until 1986, the building served as the District of Columbia's main post office. The grand public lobby featured marble writing tables, ornate lighting fixtures, clerk windows, and post office boxes, all designed to handle the heavy volume of mail

passing through the nation's capital. In 1993, after reaching an agreement with the Smithsonian, the building became home to the National Postal Museum, which occupies its atrium and lower levels and showcases extensive collections of postal history and philately.

Engineering for Preservation

In 2010, William H. Gross donated \$10 million to create a new gallery that would transform 14,000 square feet of space into the **William H. Gross Stamp Gallery**. The Smithsonian commissioned Quinn Evans as the project's architect, and Mueller Associates provided the MEP engineering required for this technically demanding project.

Stamps—tiny, delicate artifacts printed on paper—are highly vulnerable to environmental damage. Excess humidity causes paper to curl, warp, and develop mold. Insufficient humidity makes paper brittle and prone to cracking. Temperature changes accelerate the chemical breakdown of inks and paper fibers. Exposure to light—especially to ultraviolet radiation—causes permanent fading and deterioration. The new gallery would house not just stamps mounted on walls, but also hundreds of pull-out frames containing more than 20,000 objects, including artifacts never before displayed to the public.

Protection from water was essential. Mueller’s team developed multiple layers of protection: sealed floors with carefully detailed joints, drain pans beneath all water-using appliances, water-detection sensors linked to the building automation system, and alarm systems that would immediately alert staff to any infiltration of water. The domestic water system included redundant shutoff valves and pressure regulation to avoid catastrophic pipe failures. Every plumbing fixture, connection, and possible water source was evaluated for risk, and engineered accordingly.

The HVAC system required the same level of sophistication. Mueller’s engineers specified a complete direct digital control (DDC) system compatible with the existing Siemens building-wide automation network, allowing precise monitoring and control of temperature and humidity throughout the gallery. The system maintains strict environmental parameters—typically 70°F and 50% relative humidity—with minimal fluctuations. Air filtration removes particulates that could settle on stamps and accelerate degradation. The system operates continuously, maintaining stable conditions.

The electrical-distribution system was redesigned to support both the Gallery’s advanced environmental controls and



The William H. Gross Stamp Gallery—the world’s largest philatelic collection—kept at the temperature, humidity, and light levels that fragile paper demands.

its intricate exhibition lighting. The lighting design posed its own challenges: providing sufficient illumination for visitors to see tiny, printed details on stamps, while preventing the excessive light exposure that could cause fading. Mueller’s electrifying engineering team collaborated closely with the project’s exhibition and lighting designers to develop a lighting system that could be precisely regulated, with different zones receiving varying light levels, based upon the light sensitivity of the materials on display.

The project earned LEED Gold certification, in recognition of its energy efficiency and adaptive reuse of existing building space. The project demonstrated Mueller’s ability to handle the most challenging conservation needs, working within historic structures to create environments that met the Smithsonian’s standards for artifact preservation.



ENGINEERING FOR DEEP TIME: THE PALEOBIOLOGY LABORATORY

Since opening in 1911, the Smithsonian's **National Museum of Natural History's Paleobiology Department** has collected remarkable specimens documenting terrestrial and marine ecosystems across what geologists call "deep time": hundreds of millions of years of Earth's history, preserved in fossils recording the evolution of life from ancient seas, through the age of dinosaurs, to the rise of modern mammals.

By the early 2010s, 30,000 square feet of laboratories, specimen preparation areas, collections storage, a casting

room, an acid lab, and a welding shop required updated building systems. Located on the ground and basement floors, these spaces were where scientists worked with fossil-preparation chemicals, welding equipment, and dust-producing tools, which require proper ventilation and environmental controls. The Museum's extensive fossil collections also require stable temperature and humidity.

Meeting these varied demands required a carefully coordinated renovation led by Quinn Evans, with Mueller Associates designing the MEP systems laboratories.

The Engineering Challenge

Mueller's initial testing in 2012 revealed that the existing HVAC systems lacked adequate supply, return, and exhaust airflow rates, as well as the static pressures needed to support modern laboratory operations. Ductwork for the air-handling units in the penthouse, six floors above, experienced a severe pressure drop, significantly reducing air delivery to the ground floor.

The traditional solution would have been costly but straightforward: boost the supply-fan horsepower, and push more air through the existing ductwork. In collaboration with the commissioning agent, Mueller's engineers suggested a more innovative alternative: instead of adding power to compensate for the system's flaws, replace parts of the supply-air duct system with more efficient designs that cut pressure drop. This method would increase airflow capacity, without raising input power to the air-handling unit: a solution that met both the renovation's requirements, and the Smithsonian's sustainability goals.

The renovation also involved updating the lab's exhaust system. Mueller replaced the existing lab-exhaust fan with a motor and mechanical drive, to ensure proper exhaust flow and static pressure for new fume hoods, acid hoods, and overall lab-exhaust needs. The team added return-air ductwork and transfer-air fans to move air from the ground floor to the East Wing return-air shafts, ultimately creating the balanced system the spaces required.

Perhaps the most advanced solution was Mueller's proposal for the air-balance challenge. The ground-floor laboratories required a constant adjustment of airflow, due to ever-changing conditions: variable supply-air flows through numerous terminal units, intermittent use of dust collectors

and extraction snorkels, changing exhaust rates from the welding shop, and the opening and closing of fume and acid hoods. Mueller's engineers developed a control sequence that simultaneously managed all of these variables.

Two return-air transfer fans, each with its own variable-frequency controller, continuously balance net airflow to the ground floor. The DDC system measures airflow from all supply-air terminal units serving the space. It then subtracts the total exhaust airflow—separately accounting for exhaust from the bathroom, lab, welding shop, and dust collector—and adjusts the speeds of transfer fans to maintain neutral pressure on the ground floor. The system operates automatically and continuously, making real-time adjustments as scientists work throughout the laboratories.

The project targeted the lowest floor of a six-story wing, with five floors of museum operations above. The building's systems had to remain functional throughout the renovation. Mueller designed cross-connection ductwork for partial backfeed, ensuring that air continued to flow to the upper floors, even as sections of the main ductwork were removed and replaced.

A Foundation for Discovery

When the renovated laboratory opened in late 2014, it provided the Smithsonian's paleobiologists with a modern research environment. For Mueller, the project exemplified how technically advanced design could succeed within significant operational constraints. By resolving the HVAC challenge through greater system efficiency, Mueller reduced both upfront construction costs and long-term operating expenses. The project illustrates an essential truth: the most elegant solutions often come from a deep understanding of systems and how to optimize their performance.



HONORING CENTURIES OF SERVICE: THE NATIONAL NATIVE AMERICAN VETERANS MEMORIAL

On Veterans Day 2020, the **National Native American Veterans Memorial** opened on the grounds of the Smithsonian's National Museum of the American Indian. The Memorial's origins date back decades. In 1994, Congress passed the Native American Veterans Memorial Establishment Act, recognizing a long-overdue need to honor Native military service. The law was amended in 2013 to allow for the Memorial to be placed on the Museum's grounds at Fourth Street and Independence Avenue.

The Memorial design features symbols and elements common to many Native traditions: fire, water, wind, drums, the cardinal directions, and a circle. As the Memorial's focal

point, a 12-foot-tall stainless-steel circle is balanced atop a carved stone drum. Water flows continuously from the drum's center, and a fire can be lit at the base of the circle on ceremonial occasions. A granite title wall, inscribed with the five branches of the military, surrounds the Memorial.

Engineering the Sacred

The Smithsonian enlisted Quinn Evans as architect of record, and Mueller Associates to provide electrical and plumbing engineering. For Mueller's engineers, the project required precision in systems that would be mostly hidden but essential to the Memorial's function and symbolism.

The electrical systems needed to power carefully staged lighting, which would highlight the stainless-steel circle without disturbing the contemplative mood.

The plumbing systems presented other unique challenges. Water flows continuously from the center of the carved stone drum. Mueller's engineers, therefore, designed systems that would keep water flowing reliably, while also being easy to maintain over many years. Similarly, the fire feature at the base of the circle required careful coordination between gas-supply systems and safety controls, with replaceable cartridges housed in custom steel assemblies designed for easy access and maintenance.

For Mueller Associates, contributing engineering expertise to this long-overdue tribute represented the kind of meaningful work that transcends technical achievement. It is a project that honors history, serves the present, and inspires future generations to understand the extraordinary service and sacrifice of Native American veterans.

The Warriors' Circle of Honor, the National Native American Veterans Memorial, on the grounds of the National Museum of the American Indian. Water flows from the drum at its center, and Mueller's largely hidden systems sustain the water and flame that the design depends on.







MAKING LATINO HISTORY VISIBLE: MOLINA FAMILY LATINO GALLERY

The **Molina Family Latino Gallery** occupies 4,500 square feet on the first floor of the National Museum of American History, directly off the main entrance. Mueller Associates provided comprehensive MEP engineering services for the Gallery's transformation, working alongside Quinn Evans as the architect.

The Gallery needed to support intensive digital technology—interactive screens, projection systems, and audio installations—while maintaining the precise environmental controls required to protect historical artifacts. The space also had to serve multiple functions: traditional exhibition cases, a working theater, an active learning lounge, and high-traffic circulation areas, each with distinct needs.

Mueller's engineering solutions included zoning to handle different thermal demands for various spaces: the theater, with its projection equipment and focused seating; interactive galleries, with digital installations that generate heat; artifact cases that require stable temperature and humidity; and the Learning Lounge, with its continuous foot traffic.

The Gallery opened in June 2022. For Mueller, the project involved engineering that supports storytelling, fosters cultural understanding, and makes history accessible to all. Just as Mueller had helped to create an African-American exhibition that foreshadowed the National Museum of African American History and Culture, the Latino Gallery may help lay the groundwork for a future national Latino Museum.



ENGINEERING FOR FLIGHT: RENEWAL OF THE BIRD HOUSE

The Smithsonian's National Zoo & Conservation Biology Institute—commonly known as the National Zoo—was established in 1889, and the following year, landscape architect Frederick Law Olmsted began planning a facility along Rock Creek Park in Northwest Washington, which would blend natural beauty with scientific purpose.

The Zoo opened to the public in 1891 and, over the following decades, expanded across 163 acres of wooded hills and valleys, developing specialized buildings to house and study an ever-growing collection of animals. The **Bird House** was built in 1928 on a 4.5-acre elevated plain. The 30,405-square-foot building reflected a thoughtful approach to avian care and public education, featuring

both indoor exhibition spaces and outdoor aviaries that let visitors observe birds in environments similar to their natural habitats.

The Bird House was renovated in the 1960s. But by the early 21st century, it required thorough modernization to meet contemporary standards for animal welfare, conservation science, and public engagement. The building's MEP systems—originally installed long before the advent of modern climate-control and life-support technologies—could no longer provide the sophisticated environmental controls required for proper avian care.



The Prairie Pothole aviary is one of three immersive habitats in the renewed Bird House. Visitors share the space with the birds, inside conditions Mueller engineered to maintain each habitat's precise temperature and humidity.

A Modern Migration Hub

In 2017, the Smithsonian initiated a multi-year modernization to transform the Bird House into the world's first exhibit showcasing the migratory routes of North American songbirds, waterfowl, and shorebirds. Collaborating with Quinn Evans, Mueller Associates provided comprehensive MEP engineering services. Mueller's work required understanding not only building systems, but also avian physiology, conservation science, and the complex requirements involved in creating specific microenvironments within a historic structure.

From the project's outset, Smithsonian conservationists and curators set a clear priority: the aviaries are designed primarily "for the birds." The updated facility features three immersive indoor aviaries replicating the habitats of migratory birds during their journeys between Canada, the United States, and Central and South America. The three highly diverse environments mimic the Delaware Bay region, the prairie potholes of the northern Great Plains, and a Central American coffee farm. Each habitat requires distinct conditions, including specific temperature and humidity.

Engineering Life Support

The Delaware Bay aviary requires environmental conditions simulating a coastal environment—higher dewpoint, dry-bulb temperature, and relative humidity—to support shorebirds such as plovers, sandpipers, and sanderlings. The Prairie Pothole aviary requires slightly warmer conditions and different humidity levels for waterfowl. The Central American Bird-Friendly Coffee Farm requires much warmer temperatures to simulate a tropical rainforest environment, including fog production and rain-bar systems.

Mueller's engineering team achieved these conditions by specifying two separate air-handling units: one for non-habitat areas, set to a dewpoint of 55°F; and another for habitat areas, set to 61°F. But within those habitat areas, the complexity grew. The three major aviaries—Delaware Bay, Prairie Pothole, and Bird-Friendly Coffee Farm—shared the same dewpoint, but required distinctly different dry-bulb temperatures and relative humidities to replicate their respective climates. Calibrating these precise conditions within a single building presented challenges, particularly when it came to managing moisture migration between spaces that have vastly different levels of temperature and humidity. As visitors moved through the environments, they would experience a gradual progression into warmer temperatures. This was a museological achievement, in which the building's environmental systems became part of the exhibition narrative itself.

The complexity extended well beyond temperature and humidity. Each aviary has unique ventilation needs, designed to maintain air quality without creating drafts that could disrupt flight patterns. Even the air-delivery system required unusual specifications. Mueller's engineers accordingly designed linear air devices with half-inch slots,

rather than the standard three-quarter-inch openings. This modification would prevent smaller birds from flying into the ductwork, but also represented a design constraint unlike any that the team had encountered before. Similarly complex, the room for sick birds operates under negative pressure, with exhaust air sent to the building's exterior, while supply air is equipped with HEPA filters in the ducts for improved filtration. Both are crucial measures in containing the spread of avian illnesses.

The Bird House's electrical systems presented equally specialized challenges. Conventional lighting would be inadequate and potentially harmful. The bird habitats require UVA/UVB lighting fixtures. This type of lighting supports avian health, while creating naturalistic environments that change with the seasons and transition from sunrise to sunset. Significant emphasis was also placed on selecting emergency power systems, with the primary objective of protecting the birds' well-being and comfort.

The same priority—protecting the birds—drove the plumbing design, which reached unprecedented complexity: 10 separate water-piping subsystems, significantly more than the average building. All water accessible to the birds is filtered to remove inorganic impurities, and is tempered to a minimum 65°F. To achieve this, source water passes through a double-wall, plate-and-frame water-to-water heat exchanger. For areas requiring washdown, the tempered water passes through a booster pump that increases pressure to 90 PSI to hoses used for the washing of bird areas. The carbon-filtered, tempered distribution subsystem serves animal-holding areas at a lower pressure (60 PSI) to support distribution to sinks in bird-care areas, and for misting sprays within bird-holding cages. A dedicated water heater provides hot, carbon-filtered water for these sinks in these areas.



Mueller's integrated MEP systems help to regulate temperature, humidity, airflow, lighting, and water quality throughout the renovated Bird House, creating specialized habitats that support avian health, conservation, and visitor engagement.

The Central American Bird-Friendly Coffee Farm aviary needed another specialized subsystem for its fog-production and rain-bar systems. Here, water is treated with a carefully specified water softener that uses potassium chloride instead of conventional sodium chloride, to avoid soil contamination and damage to tropical plants. After softening, the water passes through reverse-osmosis filtration and UV disinfection, then enters a high-pressure fogging system.

The introduction of theatrical fog into the Coffee Farm added another layer of complexity to the environmental controls.

Mueller's design had to account for the substantial heat and moisture generated by the effect, which influenced how heating and cooling were delivered throughout the space. Maintaining stable temperature and humidity conditions required a precise understanding of the interplay among building operations, avian health, and thermodynamics.

Ten pools—a mixture of salt water and fresh water throughout the Bird House, collectively containing 6,400 gallons of water (roughly the weight of four elephants)—require filtered-water systems. Pool water is recirculated and filtered through bead or sand filters, with UV sterilization in one



The Bird-Friendly Coffee Farm aviary recreates a Central American rainforest—the warmest, most humid of the three habitats, sustained by fog and rain systems and water purified to protect its tropical plants.

pool, and a small wave machine in the Delaware Bay aviary to simulate tidal action. Additional subsystems serve public fixtures, HVAC, heating water, and backwash for life-support system filters and exterior irrigation. The water-saving fixtures and irrigation system ultimately reduce outdoor water use by 65% and indoor use by 43%: sustainability achievements that complement the building's broader environmental goals.

Perhaps most critically, each drain throughout the facility was carefully designed to prevent injuries to the birds' fragile legs. The floor of each holding enclosure includes a shallow depression with a drain; when blocked, the depression fills with water, forming a pool where birds can bathe and swim. However, the drain design required careful attention to ensure that no bird could catch a toe or leg in any opening.

A Sanctuary for Migratory Species

When the Bird House reopened in March 2023, visitors entered immersive habitats for migratory species, where Mueller's invisible systems maintain temperatures to the degree, humidity levels to the percentage point, water quality to laboratory standards, and air-circulation patterns that do not disturb birds in flight. Its LEED Gold certification and reduced energy and water use demonstrated that historic buildings can also achieve high standards of sustainability.

But perhaps most importantly, the Bird House renewal project demonstrates that engineering excellence serves not only human needs but the broader ecological community. Systems designed with care and precision support not just buildings, but life itself.



MODERNIZING AN ICON: THE NATIONAL AIR AND SPACE MUSEUM

When architect Gyo Obata of Hellmuth, Obata + Kassabaum (HOK) was commissioned to design the Smithsonian's 630,000-square-foot **National Air and Space Museum**, he drew inspiration from aircraft hangars. His design consisted of four simple marble-encased cubes housing smaller theatrical exhibits, connected by three spacious steel-and-glass atria that display larger artifacts—including entire spacecraft and rockets—suspended at vertical, horizontal, and 40-degree angles from steel trusses, ascending from the floor, or hung in dramatic positions. A bronze-glass longitudinal spine runs the full 635 feet of the building, rising through both floors of the exhibition space.

In the 40 years since its opening in 1976, the National Air and Space Museum had welcomed more than eight million visitors a year, on average, totaling more than 350 million visitors overall. However, by the second decade of the 21st century, the building had begun to experience system failures. The roof had deteriorated, skylights had been replaced multiple times, and the curtain wall and façade had been damaged by an earthquake in 2011. The building's systems had also approached the end of their lifespan.

Issues with the building envelope hindered proper humidification, and condensation threatened the collections. The

original façade was made of 1.25-inch-thick Tennessee pink marble, with spray-foam insulation on the back. An experimental air-return plenum between the façade's insulation and interior drywall meant that stone sealant was the only water barrier for the envelope. Acrylic dome skylights, which replaced the originally planned glass units to reduce costs, allowed in excessive ultraviolet radiation, threatening sensitive artifacts.

The mechanical and electrical systems, although adequate for 1976, struggled to maintain the necessary temperature and humidity levels to preserve irreplaceable objects. The Smithsonian faced a choice: either pursue incremental patch-up repairs that kept failing, or undertake a complex and significant renovation.

The Billion-Dollar Transformation

In 2013, Quinn Evans received the architectural commission, and Mueller Associates began providing mechanical, electrical, and plumbing engineering services for the Museum's \$1-billion transformation project. When Mueller learned that they had won the commission, the news carried extraordinary significance. Nearly every employee at Mueller—from front-office staff to entry-level engineers—would come to work on the project.

Mueller's engineering design started with a thorough study and evaluation of the Museum's existing systems and infrastructure. The team conducted extensive surveys, installing sensors throughout the building to monitor actual operating conditions, rather than relying upon design assumptions. The goal was precise: maintaining temperature fluctuations within a tight window, from floor level to just below the trusses, ensuring that artifacts hanging in the galleries would no longer be subject to damaging temperature extremes.

A comprehensive Revit BIM model served as the foundation for the entire project, providing detailed documentation of spaces, equipment, and finishes that would continue to function as a long-term facility-management resource. Energy modeling demonstrated that allowing limited seasonal variation in space temperature and humidity could save nearly 20% in energy—by far the most significant factor in reducing consumption. Next was the use of LED lighting with daylight sensors.

The design team used advanced modeling tools to evaluate the building envelope and interior environment. WUFI (Wärme und Feuchte Instationär) modeling analyzed vapor diffusion and moisture transport in building materials—crucial to understanding how the building envelope performs under different conditions. Two-Dimensional Building Heat-Transfer Modeling (THERM) evaluated two-dimensional heat transfer in components such as glass curtain walls and stone-clad walls, informing key decisions on the placement of insulation, glazing, and frame selection. A daylighting model measured light exposure throughout the year, informing a protection strategy that combines tinted fritted glass with interior shading devices.

Innovative Mechanical Systems

Mueller's mechanical systems embody pioneering approaches that demonstrate how cultural institutions can move beyond traditional solutions. A hybrid approach significantly enhances efficiency and resilience, reducing previous reliance on the chilled-water and steam systems. New condensing, natural-gas-fired hot-water boilers provide complete heating capacity with N+1 redundancy, eliminating reliance on steam. The system's efficiency is projected to pay for itself within less than two years: a compelling argument for institutions considering similar upgrades.



Upgraded HVAC equipment (left) serves the modernized Museum, where high-efficiency chillers and heat recovery replaced systems dating back to 1976. Electrical infrastructure (right) supports the building's controls, lighting, and life-safety systems.

The Museum's cooling plant also shows innovative thinking. Although the onsite chiller plant's capacity was only 50% of peak load, it supplied more than 80% of the annual chilled-water capacity through a combination of a variable-speed, high-efficiency centrifugal chiller and a dedicated heat-recovery rotary chiller. Chilled-water service now supplies peak capacity only when needed, maximizing efficiency and cost savings.

The dedicated heat-recovery chiller (DHRC) is a highly sophisticated solution that addresses four distinct challenges simultaneously: summer reheat, eliminating the need for boiler operation; winter cooling, eliminating the need for chilled water; supplemental heating in winter; and supplemental cooling in summer. The DHRC supplies 85%

of annual heating energy, significantly reducing the use of natural gas.

Several approaches Mueller introduced were novel not only for this building, but also across the Smithsonian's entire portfolio. The dedicated outdoor-air system (DOAS) approach addresses a fundamental challenge: outdoor air requires both cooling and dehumidification. By pre-treating this air stream separately, Mueller's solution practically eliminates the need for simultaneous cooling and reheating.

The galleries are now equipped with a high-performance variable-air-volume (HPVAV) system featuring DOAS pretreatment, air-side enthalpy energy recovery, adiabatic humidification, demand-controlled ventilation, and



A sampling of the National Air and Space Museum's reimagined galleries, where suspended aircraft and interactive displays depend upon the HVAC system's climate-control solutions and electrical infrastructure powered to preserve what they hold.

MERV-15 filtration. The DOAS effectively manages gallery dehumidification loads, allowing air-handling units to reset supply-air temperature, based on sensible cooling loads. This substantially reduces reheat requirements: a crucial efficiency gain that most visitors never notice, but which dramatically reduces energy consumption.

Mueller's humidification strategy was another significant innovation. Rather than using traditional steam humidification, the firm specified adiabatic humidifiers. The psychrometric principles—measuring moisture content in the air—were complex, but the practical result was clear: precisely maintain humidity levels, with dramatically reduced energy consumption.

Water Conservation and Plumbing

Mueller's water-conservation engineering strategy demonstrates how large cultural institutions can significantly reduce their consumption of potable water. The centerpiece for this project is a rainwater-harvesting system that leverages the building's nearly four acres of roof and terrace areas: approximately 165,000 square feet of collection surface. Two 100,000-gallon concrete cisterns, located at the eastern and western ends of the building, collect an estimated 4.4 million gallons of rainwater annually. This harvested water is used for irrigation, cooling-tower makeup, and the flushing of toilets and urinals.

These infrastructure upgrades are impressive in scope: more than 20 miles of new plumbing installed throughout the building, including a rainwater-harvesting gravity-drain system, filtered non-potable water distribution, domestic hot- and cold-water systems, and complete sanitary and vent systems. The design features duplex pumps, four 1,500-gallon day tanks, and sophisticated filtration and UV

treatment systems, ensuring appropriate water quality for various uses.

Electrical Systems and Safety

The electrical systems required equally sophisticated innovation. Mueller's creative approach integrated emergency lighting seamlessly into the building's exhibition environments, while fully complying with NFPA 101 and the *National Electrical Code*—engineering that, when done correctly, visitors will never notice.

The Museum's BAS also demonstrates significant advances in control technology. Demand-based controls continuously monitor multiple parameters: space CO₂ levels, chilled- and heating-water pressure, pressure-independent control-valve positions, differential pressures, damper positions, space conditions, and airflow metrics. The system constantly analyzes these inputs to adjust equipment set-points and supply only the energy needed to meet actual demand. This, in turn, optimizes efficiency while maintaining precise environmental conditions for artifact preservation.

Phasing and Artifact Protection

The National Air and Space Museum's renovation occurred in multiple phases, allowing parts of the building to remain open while others were being renovated. Construction started on the western side in the Fall of 2018. Hundreds of artifacts were moved to storage locations. Larger items, such as the nose of a Boeing 707 jet, remained onsite, protected by soft materials and sturdy structures with internal environmental controls.

The biggest challenge involved relocating an 18,700-pound F1 rocket engine, and a 2,000-pound quarter-section rocket



The Boeing Milestones of Flight Hall is where aircraft hang in a full-height skylit atrium. Behind its restored envelope, new mechanical and electrical systems hold steady temperature and humidity from the floor to the artifacts overhead—among the Museum’s central engineering challenges.

engine. After creating precise computer simulations of their paths through the Museum, the engines were placed on custom steel rigging with skates, and carefully moved the length of two football fields through exhibition galleries. Once in position, they were rotated 90 degrees, hoisted vertically, and suspended overhead from new steel supports.

The first phase of the renovation, encompassing eight galleries, the planetarium, the Museum store, and the Mars Café, opened in 2022. Five additional galleries, the Lockheed Martin IMAX Theater, and the redesigned Jefferson Drive entrance, followed in 2025. Five more galleries debuted on July 1, 2026, in celebration of the Museum’s 50th anniversary. The two remaining galleries will open in the Fall of 2026, completing the revitalized Museum and preparing it to inspire discovery for the next 50 years—and beyond.

Sustainability in Service of Preservation

The modernized National Air and Space Museum demonstrates how cultural institutions can advance sustainability while protecting the nation’s treasures. As the largest project in Mueller Associates’ history, it represents the culmination of decades of work with the Smithsonian and generations of expertise in preserving irreplaceable collections. The project demonstrates how creative engineering can transform seemingly conflicting demands, such as strict artifact preservation and ambitious energy performance, into complementary goals. Moreover, it reaffirms Mueller’s enduring principles of careful coordination, responsible stewardship, and engineering that quietly serves an institution’s mission. In scale, complexity, and purpose, the project stands as a defining achievement in Mueller’s six-decade history.



SAFEGUARDING NATIONAL TREASURES: THE DULLES COLLECTIONS CENTER

When the Steven F. Udvar-Hazy Center opened near Dulles International Airport in 2003, it provided much-needed exhibition space for large aircraft and spacecraft. However, as the National Air and Space Museum on the National Mall approached the extensive modernization it desperately required, a question arose: where would the Museum's valuable collection be stored during the years of construction?

In December 2016, the Smithsonian approved an expansion of its collection spaces at Udvar-Hazy: a series of specialized storage modules meant to house the Museum's artifacts during the National Mall building's renovation. These modules would offer permanent, modern storage for collections previously stored at the aging Garber facility. The first

module—the **Dulles Collections Center**, which opened in 2019—served as a vital swing space during one of the most ambitious museum renovations in American history.

Engineering for Diverse Artifacts

Working with Ayers Saint Gross—the architecture firm responsible for the National Air and Space Museum's facilities master plan—Mueller developed MEP solutions for a three-story, 124,000-square-foot building that differs from typical storage structures. The Dulles Collections Center features three large open-collection areas, each about 28,000 square feet. These spacious large-bay areas hold aircraft fuselages, spacecraft parts, and many smaller artifacts

that tell the story of human flight. Two dedicated cool- and cold-storage rooms provide specialized environments for items requiring the highest level of conservation.

The challenge lay in engineering environmental conditions that could preserve objects of great diversity and fragility. Aircraft fabric becomes brittle with temperature swings. Metallic components rust in high humidity. Painted surfaces fade under temperature stress. Archival materials deteriorate faster without precise climate control. Each artifact type requires specific environmental settings, yet the facility must also operate as a unified system, efficiently managing energy while maintaining strict protection standards.

Sophisticated Climate Control

Mueller's HVAC engineering solutions addressed these challenges with a multi-layered approach. Hydronic air-handling units on each floor serve the general storage areas, maintaining high air-circulation rates to prevent the stagnant conditions that could lead to deterioration and reducing the number of microclimates. The system includes two dedicated outside-air units that supply conditioned, dehumidified air to each general-storage air handler. These units feature energy-recovery wheels that capture heat and moisture from exhaust air, significantly improving efficiency while ensuring that incoming air meets exact specifications. In addition, the main air-handling units were cross-connected to provide partial capacity during equipment failures, requiring careful coordination of the air-distribution system.

For the cool- and cold-storage rooms housing the most sensitive objects, custom air-handling units paired with compressor-based, air-cooled refrigeration systems and specialized humidifiers were provided. These systems maintain strict temperature and humidity controls far tighter

than those of standard HVAC systems. A comprehensive DDC energy-management and -control system integrates all components, allowing facility managers to monitor and adjust conditions, while optimizing energy performance.

The electrical infrastructure was designed with equal care. The building receives 480-volt, three-phase service, and has a comprehensive power-distribution system designed for both regular operation and emergencies. A diesel generator provides backup power, ensuring that environmental systems continue to protect the collection even during extended utility outages. Energy-efficient water-cooled chillers with variable-speed chilled-water pumps reduce operational costs, while meeting the high cooling demands for climate control.

The plumbing systems were also carefully designed to minimize risks. Water is arguably the biggest threat to priceless artifacts, and every pipe, connection, and fixture was precisely engineered to prevent leaks and avoid critical areas, while ensuring essential facility operations and fire safety.

Mission Accomplished

When it opened, the Dulles Collections Center immediately began receiving artifacts as the National Air and Space Museum started the initial phase of its multi-year transformation. Iconic objects—spacecraft that had journeyed to the Moon, aircraft that had made history, and instruments that had advanced human knowledge—found temporary homes in the climate-controlled spaces Mueller had engineered. As plans progress for additional modules, the Dulles Collections Center demonstrates that even behind-the-scenes facilities receive the same rigor, foresight, and care that Mueller's engineers bring to the Smithsonian's most prominent museums.



ENGINEERING THE FUTURE OF LEARNING: THE BEZOS LEARNING CENTER

On July 14, 2021, the Smithsonian Institution announced that it had received a \$200-million donation to build a world-class education center: the **Bezos Learning Center** (BLC), housed in a new facility to be constructed on the eastern side of the National Air and Space Museum's plaza, replacing the former restaurant addition.

The BLC is being constructed on a site with its own history. When the National Air and Space Museum opened in 1976, the eastern end of the building featured an open terrace overlooking the plaza. This public space extended the Museum's connection to the National Mall. In 1988, the

Smithsonian added a glass-pavilion restaurant to this location. In addition to its educational programming, the BLC project includes a 700-seat fast-casual restaurant on the ground floor, an Astronomy Park and Observatory (featuring the permanent Phoebe Waterman Haas Observatory), and the East Terrace renovation.

Following a competitive selection process, in June 2023, the Smithsonian awarded Perkins&Will the design commission for the Bezos Learning Center. The selection of Mueller Associates as the MEP firm for the BLC reflected both a proven partnership and unmatched site expertise. For the

BLC, however, Mueller Associates offered more than just a successful alliance. Mueller's engineers knew how the Air and Space Museum's systems would operate throughout the building, where there was potential for expansion, and how the BLC's new construction would need to integrate smoothly with both the historic structure and the advanced systems being installed during the revitalization. This institutional knowledge was vital for a project that needed to seamlessly connect to the Museum's infrastructure, while also creating entirely new educational spaces.

Engineering for Multiple Functions

For the BLC, Mueller's engineers are integrating systems that serve distinctly different functions within a single facility. State-of-the-art classrooms and laboratories require a flexible power and data infrastructure capable of supporting current technologies, and future innovations yet to be imagined. The 700-seat restaurant requires commercial-grade kitchen ventilation, sophisticated climate control for dining comfort, and plumbing systems sized for high-volume food-service operations. The Phoebe Waterman Haas Public Observatory requires specialized environmental controls to protect sensitive astronomical equipment while allowing public access. Public gathering spaces also need to connect seamlessly to the Air and Space Museum's existing infrastructure.

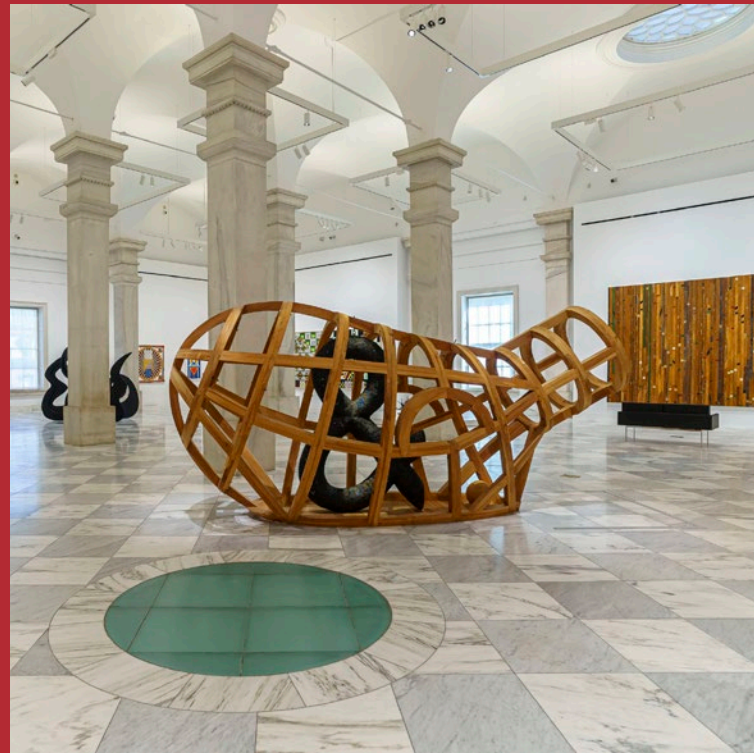
Renovation of the loading dock (serving both the BLC and the Museum) presented its own coordination challenges, requiring the design team to maintain operational access for collections and supplies, while construction proceeds around active areas. Further, the East Terrace improvements will transform exterior spaces into extensions of the learning environment, requiring careful integration of lighting, power, and potential interactive elements.

Looking Forward

Construction of the Bezos Learning Center began in 2025, with completion expected in 2027. Its opening will follow the full renovation of the National Air and Space Museum, extending the transformation of one of the Smithsonian's most prominent sites on the National Mall. Together, Mueller's extensive work at the Hirshhorn Museum and Sculpture Garden, the comprehensive modernization of the National Air and Space Museum, and the Bezos Learning Center represent an extraordinary concentration of engineering stewardship within a single Washington, D.C., city block—advancing three internationally significant cultural institutions at the heart of the National Mall.

Their importance also reflects a much broader legacy. Through studies, targeted interventions, small-scale renovations, and comprehensive building upgrades, Mueller Associates has contributed to every Smithsonian building on the National Mall. This extraordinary breadth of experience demonstrates how sustained partnership, institutional knowledge, and consistent technical excellence can support both the daily stewardship and long-term evolution of America's most visible cultural institutions.

Mueller's partnership with the Smithsonian spans more than 100 projects. Clockwise from upper left: the Conservation Pavilion at the National Zoo; the renovated Smithsonian American Art Museum; and the café and the conservation lab at the Hirshhorn Museum—each supported by Mueller's mechanical, electrical, and plumbing engineering.





CHAPTER 13

Engineering the Future

In the summer of 2024, the leadership of Mueller Associates gathered for two intensive days to chart the firm's future. They assembled not just to celebrate decades of engineering excellence—although that certainly warranted celebration—but to engage in the honest, searching type of conversation that defines organizations committed to continuous improvement and long-term success. The questions they faced were fundamental: Could a firm that had weathered a series of economic downturns, the tribulations of the EA-Mueller period, and a global pandemic build the kind of workplace culture that would attract the next generation of engineering talent?

Six years earlier, Mueller's leadership had gathered for a similar purpose, commissioning an outside consultant to produce the firm's first comprehensive strategic plan. That session had focused primarily upon operational excellence and organizational resilience: streamlining staff performance reviews, implementing leadership succession planning, fine-tuning project delivery processes, and—most prescient in hindsight—preparing for an economic downturn.

The culmination of that initial process was the 2019–2024 Strategic Plan, which emphasized awareness and preparation. The plan also established monitoring systems for economic indicators such as stock market performance, unemployment rates, and office vacancy rates. The plan called for tracking market-specific data in Mueller’s core sectors: higher education, federal contracting, cultural institutions, and defense spending. “Take advantage of market diversification and targeting recession-resilient markets,” the plan advised. “Continue marketing and business development activities, even in good times.”

The wisdom of this preparation became evident far sooner than anyone anticipated. Within a year of the plan’s implementation, COVID-19 would transform not only the economy, but also the fundamental nature of professional work itself. Offices emptied overnight. Construction sites fell silent. Project managers, who had spent their careers coordinating work face to face, now conducted site inspections via video calls. Across the architecture, engineering, and construction (AEC) industry, firms implemented hiring freezes, postponed projects indefinitely, or simply waited to see which way the economic winds would blow.

Armed with its strategic framework and culture of adaptability, Mueller charted a different course. While competitors implemented hiring freezes or reductions, Mueller expanded its staff after winning several significant commissions. The firm’s diversified portfolio offered the stability that specialized firms lacked.

A Shift in Strategic Focus

Having achieved the overarching goals of the 2019–2024 Strategic Plan, Mueller’s leaders approached the next strategic planning session with a different set of questions.

The firm had weathered economic storms and maintained technical excellence. But could it build the kind of workplace culture that attracts and retains the engineering talent essential to long-term success?

The question was neither theoretical nor premature. Similar to other engineering firms nationwide, Mueller was not immune to the Great Resignation that swept through the workforce in the aftermath of COVID-19.

Engineers departed for various reasons. Some left the profession entirely, choosing careers in software development or project management, where their technical skills commanded premium salaries. Others relocated to firms in different states, following partners or seeking lower costs of living. Still others accepted positions at companies offering fully remote work—a benefit that, in the pandemic’s aftermath, had transformed from luxury into expectation for many professionals. The exodus also reflected broader generational shifts in how people, especially younger staff, conceptualized work, career, and the relationship between professional achievement and personal fulfillment.

The AEC industry faced a unique recruiting challenge. Although technology companies could showcase world-changing products with a clear societal impact, AEC firms operate largely behind the scenes. As for Mueller, the general public encounters the firm’s work daily—at museums, theaters, and universities—without recognizing the sophisticated engineering that makes these experiences possible. How could Mueller compete for talent with industries that offered both higher starting salaries and more immediately visible contributions to society?

Mueller’s leadership recognized that answering this question required looking inward. Technical excellence, project

diversity, and financial stability were necessary but insufficient. The firm needed to articulate and actively cultivate a distinctive culture that would make Mueller not only a good employer, but also a genuinely exceptional place to build a career in engineering.

The strategic planning sessions in the Summer of 2024 confronted this reality directly. Mueller needed to shift from being “an excellent place to start your career” to being “an exceptional place to build your career.” It required articulating—perhaps for the first time in the firm’s nearly 60-year history—what made a Mueller career valuable, not merely in the short term but across decades.

The question before Mueller’s leadership was fundamental: Could a firm built upon unspoken values learn to speak them? Could loyalty be taught rather than merely absorbed? Could Mueller preserve what made it strong, while adapting to a labor market that valued mobility over tenure?

The 2025–2030 Strategic Plan would attempt to answer those questions. Thus, unlike the operationally focused 2019–2024 plan, the 2025–2030 Strategic Plan centered on a single overarching goal: for Mueller Associates to be “recognized as a ‘best place to work’ where engineers can learn, develop, and build their careers.”

MUELLER’S PEOPLE: THE HEART OF THE 2025–2030 STRATEGIC PLAN

The strategies flowing from the Strategic Plan touched upon every aspect of the employee experience, from initial recruitment through career development, to leadership opportunities. Rather than treating workforce challenges as isolated human-resource problems, Mueller’s plan approached them holistically, recognizing that creating an exceptional workplace requires coordinated attention to attraction and recruiting, compensation, policies and benefits, remote-work flexibility, training and development, and human-resources management.

The plan called for highlighting “the cool factor of Mueller’s iconic projects.” It was a direct acknowledgment that young engineers want to work on buildings and systems that matter: projects that push technical boundaries, while contributing to cultural institutions and educational advancement. But Mueller’s recruiting strategy needed to extend beyond

showcasing impressive projects. The plan challenged long-held assumptions about what makes a successful engineer. “Valuable design and production staff don’t necessarily aspire to become project managers or principals,” it noted, recognizing that technical excellence and leadership are distinct capabilities that don’t always reside in the same individual.

This change in perspective reflected a fundamental insight: Mueller’s future depended not upon finding more people who fit a predetermined mold, but on expanding the definition of who can succeed in engineering, while maintaining the technical rigor that had come to define the firm.

Flexibility and Benefits

Most significantly, the Strategic Plan directly addressed the remote-work question that had vexed professional-services firms since the onset of COVID-19. Rather than requiring a full-time office presence or adopting fully remote arrangements, Mueller proposed reducing the required in-office days from five to four, with those in-office days “prescribed to provide value for employees” through mentoring, communication, and coordination. The plan acknowledged both the benefits of flexibility, and the real costs to training and development when experienced engineers and emerging professionals did not interact regularly.

Mueller’s measured approach to remote work has proven prescient. While other firms rushed to implement full-time remote-work policies during and in the immediate aftermath of the pandemic, Mueller safely and responsibly brought employees back to the office, continuing to promote flexibility and work-from-home options, while recognizing what had made the firm strong for nearly six decades.

The interdisciplinary collaboration that allows mechanical engineers to learn from electrical colleagues, the mentorship relationships in which senior engineers guide junior staff through complex technical challenges, and the spontaneous problem-solving that occurs when project teams occupy shared space—these essential elements of Mueller’s culture couldn’t be fully replicated through video calls.

After several years of predominantly remote or virtual work, many firms struggled to entice employees to return to the office, facing resistance from staff who had grown accustomed to working from home. Mueller’s culture, by contrast, had already adapted to a hybrid model that preserved in-office collaboration while offering flexibility. In

fact, younger engineers—especially those who had graduated during or immediately after COVID-19, and had begun their careers in isolated, remote environments—expressed gratitude for Mueller’s in-office culture, recognizing that their professional development accelerated dramatically through direct interaction with experienced colleagues.

Mueller’s commitment to flexibility went beyond remote-work policies to include creative approaches to work-life balance. In summer 2024, the firm launched a pilot program: employees who met their deadlines could leave early on Fridays. Leadership approached the experiment with cautious optimism. Would engineers take advantage without completing their work? Would projects fall behind schedule? Would Friday afternoon meetings become impossible to coordinate? The concerns were real, but so was the potential benefit.

The results surprised even the program’s advocates. Project managers reported that engineers produced deliverables days ahead of schedule. Rather than rushing to leave early, employees planned their work more strategically, front-loading tasks earlier in the week and eliminating the time-wasting habits that had crept into their routines. The early Friday departure became an incentive that actually improved productivity. Engineers worked more efficiently during the week, managed their time more effectively, and approached deadline-driven tasks with renewed focus. What leadership had feared might reduce output instead revealed untapped capacity that had always existed, but had never been properly motivated.

Other renewed and improved benefits included updating the mix of recognized and floating holidays, new paid parental-leave policies, expanded health insurance benefits, a new student loan assistance program, and revised paid time off.

Strategic Vision to Organizational Reality

As Mueller approached its 60th anniversary, the firm’s strategic evolution reflected broader transformations in how professional organizations define success. The 2019–2024 Strategic Plan represented conventional thinking: identify external threats, develop mitigation strategies, monitor key indicators, and maintain organizational flexibility. That approach proved valuable during the pandemic-related disruptions in 2020.

The 2025–2030 Strategic Plan, however, ventured into less-charted territory: building organizational culture, rethinking fundamental assumptions about work and careers, and investing in workplace qualities that cannot be easily quantified in bookings and billing reports.

The shift represented a bet informed by experience, albeit still requiring conviction. In an industry where technical competency is increasingly commoditized, and talented engineers can work remotely for firms worldwide, what distinguishes one employer from another? Mueller’s leaders wagered that organizational culture had become the decisive competitive advantage. Engineers who feel genuinely supported in their development, who work on technically challenging projects with cultural significance, and who experience their workplace as a community rather than merely an employer, will choose to build their careers at Mueller, even when other opportunities arise. They will turn down higher salaries elsewhere. They will decline fully remote positions. They will stay because of relationships, mission, and the satisfaction of difficult work done well.

The projects presented in this chapter demonstrate why that bet is justified. They showcase the kind of work that gives meaning to engineering careers. It is work that allows

Mueller Associate’s 5-Year Vision

By 2030, Mueller Associates will:

Target Markets
Continue to be thought leaders in our primary markets:

- Cultural (museums, performing arts facilities, libraries, and archival storage)
- Higher education
- Northrop Grumman
- Select federal (non-DoD agencies)

Services

- Continue to provide quality MEP services.
- Provide energy modeling services in-house.
- Provide fire protection/fire alarm services with a trusted consultant partner.

Geographic Presence

- Maintain our focus on the mid-Atlantic region.
- Selectively respond to unique project opportunities out of our geographic area.

Culture
To be recognized by media publications and industry associations as a “best place to work” where staff can learn, develop, and build their careers.

Staff Size
Employee 55 total staff.

KEY PLANNING TOPICS
Our strategic planning workshop was created with top-priority strategic initiatives that were addressed in the strategic plan. The 4 key planning topics are as follows:

1. Markets, Services, Geography, and Marketing/Business Development
2. Mueller’s People
3. Project Delivery
4. Leadership and Succession



Mueller’s road map to 2030, setting goals across markets, services, and geographical reach.

technical professionals to point to buildings and systems they helped create and say, “I contributed to that. My work matters.” These projects also illustrate how Mueller’s six decades of experience, technical expertise, and commitment to excellence have positioned the firm to address the most demanding and rewarding challenges in contemporary building-systems engineering.



HARMONIZING PERFORMANCE AND EDUCATION: SAINT MARY'S COLLEGE OF MARYLAND'S DODGE PERFORMING ARTS CENTER

On a historic waterfront campus where Maryland's Colonial past meets contemporary academic excellence, Saint Mary's College of Maryland faced a question that would define its cultural future: How could a small public honors college build a performing arts facility capable of attracting world-class talent, while also serving its students' educational needs? The answer would need to satisfy competing demands.

The building had to integrate seamlessly into the architectural character of the campus's Academic Tidewater Village, and respect the College's past. Yet it also had to establish itself as a cultural beacon for the entire Southern Maryland region—serving both the present and the future. In addition, it had to be simultaneously intimate enough for student

recitals, and sophisticated enough for touring professionals. It had to feel like a campus building to students, and a destination venue to the broader community.

The **Nancy R. & Norton T. Dodge Performing Arts Center**, which opened in 2022, is Saint Mary's bold answer to these challenges. Designed in tandem with the adjacent **Dean Learning Commons**, the two buildings have resulted in a dynamic new campus gateway. Mueller Associates provided mechanical and electrical engineering design services for this milestone project, working closely with GWWO Architects and the GUND Partnership to create facilities that seamlessly integrate artistic excellence with pedagogical innovation.

“The Dodge Performing Arts Center reflects our commitment to engineering that enhances both the user experience and environmental performance,” said Steven Gillis, principal at Mueller, who oversaw the projects. “Our team was tasked with creating systems that would meet the exacting acoustical requirements of a premier performance venue, while achieving ambitious sustainability goals. The success of this project demonstrates how thoughtful engineering can support artistic expression, while significantly reducing energy consumption—a win for both the college and the environment.”

Strategic Integration With Campus Life

Located in the core academic district, the Performing Arts Center thoughtfully connects with adjacent campus housing, enlivening and energizing the learning environment in ways that extend far beyond their immediate footprints. This redevelopment of a central campus area transformed a former athletic field into a highly accessible cultural and academic hub for the entire college community that, together with the redesigned campus landscape, completes a network of pathways connecting the core academic area with residential neighborhoods to the east and north.

The design draws upon the vocabulary of the Academic Tidewater Village’s architectural context to unify the two new buildings within the campus’ overall composition, while allowing key program elements to be expressed and celebrated. The entrance to the Performing Arts Center maintains high visibility from the academic core, creating a strong physical and symbolic connection between the facility and campus center. The Dean Learning Commons is located on the northern edge of a new green space, helping to define the area between the nearby Crescent Townhomes development and the academic core.

A World-Class Performance Venue

The centerpiece of the Dodge Performing Arts Center is a carefully engineered auditorium that supports an extraordinarily diverse programming schedule, ranging from orchestral and choral performances to theatrical productions, lectures, and community events. The auditorium has 450 seats on the main floor, 250 in surrounding tiers, and 250 in the balcony, resulting in an intimate yet versatile performance environment that fosters genuine connection between performers and audiences. Producing this sense of intimacy within a substantial venue is a significant architectural and acoustical achievement—one that required sophisticated engineering solutions.

Supporting spaces extend the building’s functionality across a comprehensive range of musical and theatrical needs. A 125-seat recital hall with precise acoustics provides an ideal environment for chamber music, student recitals, and small-ensemble performances. Professional-grade rehearsal studios offer musicians and performers areas in which to refine their craft under optimal acoustical conditions. Dedicated classrooms and offices establish the building as the institutional home for the College’s music program. A striking floor-to-ceiling curved-glass lobby serves as a reception area, visually connecting the building to the surrounding campus, while providing a gathering place for pre-performance conversations and intermissions.

Engineering for Acoustical Excellence

Performance spaces in the Dodge Performing Arts Center were designed with special attention to acoustics and intimacy, creating an engaging experience that fosters connection between performers and audiences, while inspiring confidence and achievement.



The grand piano anchoring this warm, wood-lined hall at the Dodge Center depends upon more than its player: engineered humidity controls keep the instrument in tune, a safeguard the audience never sees.

For Mueller's engineering team, meeting these exacting requirements, while maintaining visual elegance and operational efficiency, demanded innovative solutions across multiple systems.

Ultra-low-velocity air-distribution systems minimize background noise in performance spaces: a critical requirement for any venue that hosts everything from solo piano recitals to full orchestral performances. In conventional HVAC systems, air movement through ductwork and diffusers can generate perceptible noise that interferes with musical performances. Mueller's design reduces air velocities to levels that remain acoustically imperceptible, while still providing adequate ventilation and temperature control for occupied spaces. Isolating vibrations for all mechanical equipment prevents the unwanted transmission of sound through the

building structure. Mechanical equipment—particularly chillers, pumps, and air-handling units—can generate vibrations that propagate through structural elements, manifesting as low-frequency rumbling in performance spaces. Mueller implemented comprehensive vibration-isolation strategies that effectively decouple mechanical systems from the building structure, ensuring that they operate without affecting the building's performance.

The strategic placement of mechanical systems away from performance spaces provides additional acoustical protection. Sound-attenuated ductwork and piping systems further reduce the potential transmission of noise, while variable-air-volume systems with acoustical damping ensure that the engineering infrastructure remains invisible to performers and audiences alike.

Climate Control for Diverse Spaces

The auditorium has an underfloor air-distribution system that enhances comfort and optimizes stratification during high-occupancy events. Unlike conventional overhead air distribution, which delivers conditioned air from ceiling-mounted diffusers, underfloor systems deliver conditioned air at low velocity from floor-level diffusers. This approach leverages natural convection: as audience members generate body heat, warm air rises and is replaced by cooler air from below. The result enhances audience comfort during performances, while improving energy efficiency.

Climate-control systems throughout the facility provide precise humidity regulation to protect valuable musical instruments. String instruments, pianos, and woodwinds are all sensitive to fluctuations in humidity, which can not only cause instruments to go out of tune, but also structural damage and reduced lifespan. Mueller's systems maintain stable humidity levels year-round, ensuring that instruments stored and used in the building remain in optimal condition.

Temperature management addresses varying occupancy loads throughout the facility. Mueller's zoning strategy ensures that each space receives appropriate conditioning based on its actual occupancy and use patterns, rather than treating the entire building as a single thermal zone.

Advanced air-distribution systems operate efficiently in both occupied and unoccupied modes, automatically adjusting ventilation rates and temperature setpoints, based on building-occupancy schedules. Specialized ventilation and air-conditioning systems for the glass lobby maintain comfort during receptions. Together, these strategies address the distinct environmental needs of performances, rehearsals, instruction, instrument storage, and public gatherings.

Electrical Infrastructure for Excellence

The Center's electrical infrastructure reflects Mueller's expertise in performance-venue engineering design. Advanced dimming and control systems provide the precision needed for sophisticated lighting, enabling lighting designers to create everything from subtle mood lighting for intimate performances, to complex cue sequences for full-scale theatrical productions.

Carefully segregated emergency and show-power systems support both safety requirements and continuity of performance. Mueller's design provides clean, isolated power for performance systems, and ensures that emergency systems maintain appropriate separation and redundancy.

The electrical distribution system's flexible design accommodates the varying power demands of different productions, from intimate recitals requiring minimal technical support to full-scale theatrical performances with extensive lighting, sound amplification, and automation for scenery. This flexibility ensures that the venue can host diverse programming without requiring infrastructure modifications.

Sustainability Through Integrated Design

Saint Mary's College demonstrates its commitment to sustainability through responsible stewardship, and this LEED Silver building continues that proud tradition. The project employed a sophisticated combination of passive and mechanical engineering strategies to achieve ambitious energy goals, ultimately achieving 21.5% energy savings, compared to the ASHRAE 90.1-2010 baseline standard.

Passive design strategies played a significant role in the project's energy-performance success. The two buildings



The Dodge Center wears the brick of Saint Mary's historic campus: softened by the curved glass of its lobby, a traditional façade that gives little away about the high-performance building behind it.

were carefully sited to maximize north-south exposure, while minimizing east-west exposure whenever possible, thereby reducing solar heat gain during peak cooling periods. The window-to-wall ratio was kept to a modest 23%, balancing the benefits of natural daylighting, and views, with the thermal-performance drawbacks of excessive glazing. Ceramic frit was strategically applied to glazing in high-solar-exposure areas, reducing heat gain while maintaining visual transparency.

The building's lighting system is primarily LED, giving it a lighting-power density 58% below ASHRAE 90.1-2010 requirements. This dramatic reduction results from both the inherent efficiency of LEDs, and the application of intelligent controls. The lighting system incorporates dimming

capabilities, daylighting sensors reduce artificial lighting when natural light is available, and occupancy detection ensures that lights operate only when spaces are in use.

Mueller's engineering systems complement these passive strategies with high-efficiency air-cooled chillers, and condensing boilers that supply the variable-air-volume (VAV) systems. The primary VAV systems feature energy recovery to minimize the energy penalty associated with ventilation requirements: a particularly important consideration for a building that must provide substantial outdoor air for large-occupancy spaces like the auditorium. Sophisticated controls include economizers that provide free cooling when outdoor conditions permit, duct static-pressure reset that reduces fan-energy consumption during partial-load



Students gather (top) in the daylit lobby of the Dodge Center before a performance. In a professional-grade rehearsal studio (bottom), engineered acoustics and natural light support the quiet, exacting work of refining a musical piece.

conditions, a supply-air temperature reset that optimizes system efficiency across varying loads, and demand-control ventilation that modulates outdoor air based on actual occupancy levels, rather than design maximums.

Solar panels prominently positioned on the southern façade make the building's commitment to renewable energy visible to anyone approaching it. Beyond their functional role in generating electricity, these panels serve an educational purpose, demonstrating the College's environmental values to students, visitors, and the wider community.

The project's excellence was recognized by the American Institute of Architects (AIA). The Dodge Performing Arts Center and Dean Learning Commons was named AIA Maryland's Public Building of the Year in 2023—an honor acknowledging outstanding design quality and the successful integration of architectural vision with technical performance. Mueller's engineering contributed to that achievement by providing quiet, efficient, and precisely controlled environments tailored to the facility's varied educational and performance spaces.



BRIDGING TRADITION AND INNOVATION: THE MARY M. TORGGLER FINE ARTS CENTER AT CHRISTOPHER NEWPORT UNIVERSITY

When Christopher Newport University envisioned a new facility that would serve as both an academic home for its growing fine arts programs and a regional cultural destination, the institution faced an architectural puzzle with no obvious solution. The building would need to connect with the existing Ferguson Center for the Performing Arts—a distinctly modern structure designed by legendary architect I.M. Pei—while simultaneously transitioning toward the Neo-Georgian vocabulary that defines the main campus. How do you bridge Modernist and traditional aesthetics without creating architectural confusion? How do you honor Pei's vision while establishing your own identity?

More fundamentally, the building faced a dual mission that often yielded compromised results. It needed to establish itself as a serious player within the competitive regional arts-institution landscape, while remaining closely connected to the University's educational mission of undergraduate excellence. Museums and universities have different masters. Could a single building serve both equally well?

The **Mary M. Torggler Fine Arts Center**, which opened in 2022, reflects Christopher Newport's bold answer to these challenges. This 88,060-square-foot facility stands as a sparkling gem on the University's jewel-box campus,

seamlessly blending modern design with traditional architectural vocabulary, and establishing itself as a forward-looking institution. Mueller provided comprehensive mechanical, electrical, and plumbing engineering services for this transformative project, collaborating with Glavé & Holmes Architecture to create a facility that serves as the University's fine arts hub.

"Our challenge was to create building systems that could support the precise environmental conditions needed for a museum-quality exhibition space, while complementing the dramatic architectural elements," said Daniel Carmine, senior project manager at Mueller, who oversaw the project.

Connecting Campus and Community

The Torggler Center's most striking feature rises above the brick façade: three cascading glass domes capping a luminous central atrium. They symbolize the three ships—the *Discovery*, *Godspeed*, and *Susan Constant*—that carried English colonists to Virginia in 1607 under Christopher Newport, the mariner and privateer for whom the University is named. On sunny days, light pours through the domes into the rotunda in patterns that shift with the passing clouds, and visitors arriving from campus crane their necks upward before they reach the door. The domes announce the building's purpose before anyone crosses the threshold: this is where light and art converge.

Spaces for Experiencing and Creating Art

The Torggler Center houses an impressive range of purpose-built environments for experiencing and creating art. The Anne Noland Edwards Gallery, the primary exhibition space, spans most of the second and third floors; its movable walls and structures can be reconfigured for

each show, an essential feature for a facility built to host traveling exhibitions with widely varying display needs. Smaller galleries serve distinct audiences: the William M. Grace Community Gallery for local and regional artists; an Academic Gallery for Christopher Newport students, faculty, and alumni; a Microgallery for experimental work; and an interactive Art Explorers Gallery for children. A café and two children's classrooms in the atrium area give families a place to experience art together, and the space between the Torggler and the neighboring Ferguson Center serves as an outdoor museum.

Teaching and studio spaces occupy much of the rest of the building. A 150-seat lecture hall anchors instruction in art history and criticism, while studio classrooms host both academic and public courses. The studios themselves climb the building floor by floor: sculpture and ceramics on the first, with the specialized ventilation and utilities those media demand; photography and digital arts on the second, including a darkroom, photo lab, light lab, and digital studios; and drawing and painting on the third, where north-facing windows admit the even, indirect light artists prize.

Museum-Quality Environmental Control

Hosting nationally significant traveling exhibitions demanded museum-grade climate control. A dedicated air-handling unit serves the gallery areas, holding temperature and humidity within the narrow tolerances that protect paintings, works on paper, textiles, and other vulnerable materials. Six temperature zones, each with its own humidity sensor, let setpoints vary slightly by use and occupancy, while the system averages humidity across all of them—keeping conditions stable even as visitor loads, weather, and building operations pull the HVAC infrastructure in different directions.

That stability is the point. Humidity is kept especially tight to prevent the differential moisture movement that swells and shrinks hygroscopic materials, such as paper, canvas, and wood. Constant circulation eliminates stagnant pockets and temperature stratification, and filtration removes particulates that could soil or abrade works of art. Above all, the system runs continuously, on the principle that most damage to art comes not from any single instantaneous condition, but from fluctuation and cycling.

Balancing Visibility and Art Protection

Working with the architectural team's lighting designers, Mueller's electrical engineers wove natural daylight, abundant in the atrium, together with supplemental artificial light: photo sensors track available daylight and adjust the fixtures to keep illumination steady and energy use low, while programmable controls tailor lighting scenes to each exhibition, event, and time of day, shifting between them smoothly rather than abruptly. Because the glass domes flood the galleries with daylight that swings with the weather and the hour, carefully placed shades, selective glazing, and coordination with the HVAC system to manage solar heat gain work together to ensure that natural light enhances the art rather than threatening it.

Specialized Infrastructure for Art Studios

Studios that handle hazardous or messy materials each needed custom exhaust and ventilation, and each posed a different challenge. Ceramic kilns exceed 2,300°F for hours at a time; without dedicated exhaust, that heat would radiate into adjacent rooms and overwhelm cooling systems already straining against the summer Sun, turning studios into furnaces. Darkrooms must stay light-tight yet still breathe, which complicates duct routing—any gap that

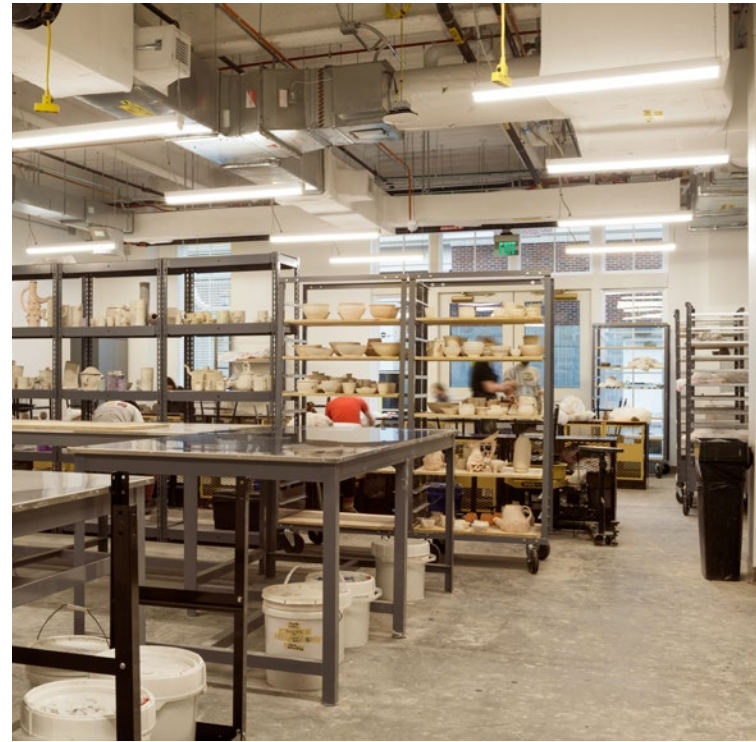
admits light defeats the room's purpose. Painting studios must clear solvent fumes with air movement gentle enough not to disturb wet canvases. Each constraint had to be met without affecting the others.

The electrical and plumbing demands were just as particular. Kilns draw high-voltage, high-amperage circuits; photography labs need dedicated power for enlargers, processors, and dryers, under carefully controlled lighting; digital studios require abundant power and data for workstations and large-format printers; sculpture studios need outlets placed for mobile power tools. On the plumbing side, ceramic floor drains use clay traps to keep sediment out of the sanitary system, darkrooms neutralize acidic chemical waste, and studio sinks are built to withstand the solvents, pigments, and cleaners that would destroy ordinary fixtures.

Engineering the Iconic Glass Domes

The cascading glass domes are the Center's signature—and its most difficult mechanical engineering challenge. Their extensive glazing admits solar heat gain that swings sharply with season, hour, and weather: summer afternoons threaten to overheat the atrium, while winter mornings bleed radiant heat through the cold glass and invite drafts.

To hold the space stable against those swings, Mueller's engineers turned to computational fluid-dynamics modeling, which mapped how warm air climbs toward the apex of the domes, while cooler air sinks along the perimeter glazing. This allowed them to place supply and return air so that it worked with the convection rather than against it: cool air enters low, rises as it picks up heat from occupants and sunshine, and is drawn off through return grilles near the dome peaks—keeping the atrium comfortable while leaving the architecture visually uninterrupted. The domes'



The Torggler's three cascading glass domes (left)—symbolizing the Discovery, Godspeed, and Susan Constant that carried Christopher Newport to Virginia in 1607—crown the daylit rotunda. A ceramics studio (right), one of the specialized spaces where kilns and clay call for purpose-built exhaust and plumbing.

abundant, ever-shifting daylight is handled by the same daylight-balancing controls used throughout the galleries.

Seamless Systems Integration

Making all of this disappear was a design goal in itself. Ductwork follows the structure, conduits and junction boxes vanish into walls and ceilings, and plumbing risers hide in maintenance-accessible chases. In the glass-domed atrium, radiant heating disappears into the floor, supply devices are hidden underneath the balcony, return grilles blend into the architecture, and light fixtures tuck against structural elements. The systems work without detracting from the art.

“One of our greatest challenges was designing systems that could maintain strict temperature and humidity control for art preservation, while accommodating significant solar loads from the signature glass domes,” said Matt Velky, project manager and lead mechanical engineer at Mueller. “By employing advanced modeling, and carefully coordinating with the architectural team, we developed solutions that protect valuable works of art while preserving the dramatic visual impact that makes this facility so distinctive.”

At the Torggler, every system—climate control, lighting, studio infrastructure, and the domes themselves—succeeds precisely by staying invisible, quietly serving the Center’s higher purpose.



BREAKING BOUNDARIES: RADFORD UNIVERSITY'S ARTIS CENTER FOR ADAPTIVE INNOVATION AND CREATIVITY

When Radford University set out to unite the visual and performing arts with health sciences and nursing under one roof, it understood the audacity of the idea. For more than a century, American higher education has sorted knowledge into silos—science in laboratory buildings, theater in performing arts centers, nursing in clinical facilities. Radford proposed to demolish those walls. A music therapist working with stroke patients needs both musical theory and neurological rehabilitation; the convergence was not aspirational, but necessary.

That vision opened to students in the Fall of 2024 as the **Artis Center for Adaptive Innovation and Creativity**—at 178,000

square feet, it's the largest academic building on campus. Mueller Associates provided the mechanical, electrical, plumbing, and fire-protection engineering, working with architects Hord Coplan Macht and William Rawn Associates. The project was unlike any the firm had ever faced. "The Artis Center presented a fascinating engineering challenge," recalled Tom Syvertsen, principal at Mueller. "We needed to create systems that could simultaneously support the acoustical environment of a recording studio, the heavy ventilation requirements of art studios, and the precise temperature and humidity control needed for health sciences—all while ensuring that these systems remained virtually invisible to the building's occupants."



A Multifaceted Educational Environment

The building's program is what made the engineering so complex. It was an extraordinary range of spaces, each of which carried the stringent requirements of a purpose-built facility. Performance venues alone include a 500-seat proscenium theater with a full fly system, orchestra pit lift, and professional consoles; a 200-seat black box for student productions; and a studio theater for dance. At the center sits the Performance Hub, a soaring atrium whose "learning stairs" host pop-up concerts, fashion shows, and gatherings, turning circulation space into an impromptu stage.

Spaces clustered around the performance venues could hardly be more different from one another. Clinical suites with observation rooms let music- and speech-therapy students train together; a pod-configured classroom seats

80 nursing students; art studios serve painting, drawing, ceramics, and photography; and the theater's costume, design, and scene shops demand their own ventilation and power. Music facilities—a recording studio, piano and therapy classrooms—require tight acoustical and environmental controls, while the dance studios, designed as transparent "jewel boxes" open to view from across the building, posed their own puzzles related to climate control and sound isolation. Interior design and CAD labs, fashion studios, a maker space, and an outdoor courtyard amphitheater round out the suite of spaces at the Artis Center.

Solutions for Conflicting Requirements

Few buildings place such radically different demands on the air within them. A single building now had to contain medical contaminants from clinical exam rooms, solvent fumes from

oil-painting studios, clay dust from pottery wheels, the oil-based makeup from theater dressing rooms, and the tightly maintained humidity that keeps a grand piano in tune. Each program demanded isolation from the others, so Mueller's engineers built a dedicated air-handling strategy of carefully zoned systems that confined each type of air, keeping the turpentine vapors of a painting class out of a music-therapy session one floor below, and the antiseptic odors of a clinic away from a recording studio, where microphones can be spoiled by even slight contamination.

Sound was the second issue, presenting a similar challenge in a building designed for openness and sightlines between spaces. Mueller reduced duct-air velocities, placed silencers at critical junctions, and ran double-wall ductwork where sound control mattered most, coordinating sound lining and pipe- and duct-lagging so that the main theater, black box, and recording rooms were free of sound bleed, despite the same systems serving the health-sciences spaces beside them. The result is that a ceramics class can run one floor above a recording session, with each oblivious to the other.

Breaking Down Educational Silos

The building resists rigid departmental zones, interspersing classrooms and studios so that disciplines meet by design rather than by chance. Glass-enclosed studios and open sightlines make the collaboration visible: a speech-therapy class works within view of sketching artists, theater students lend their craft to nursing simulations, music therapists compare notes with health-sciences peers.

For Mueller, that openness meant abandoning the usual practice of optimizing separate systems for separate departments, in favor of a single integrated infrastructure flexible enough to meet each space's needs at once. It was



A dance class in one of the Artis Center's glass "jewel box" studios—built to be watched from across the building. Mueller's integrated climate-control systems keep the glass-enclosed studio comfortable, evenly conditioned, and free from distracting drafts.

engineering conceived, like the building itself, to erase boundaries, rather than reinforce them.

Since opening, the Artis Center has become the vibrant heart of Radford's campus—proof of what follows when leadership challenges convention, architects embrace complexity, and engineers make an ambitious vision work. Here, nursing students learn alongside theater majors and music therapists beside speech pathologists; artists and healers share the same corridors, breathing the same carefully conditioned air, their work sustained by systems no one sees. It is a fitting home for an institution preparing students not for the jobs of today, but for the uncertain challenges ahead—the kind that will demand exactly the collaborative thinking this building was designed to foster.



EMPOWERING VOICES THROUGH ENGINEERING: BOWIE STATE UNIVERSITY'S MARTIN LUTHER KING, JR. COMMUNICATION ARTS AND HUMANITIES BUILDING

When Bowie State University's planners gathered in 2020 to envision a new communications building, the country was in the midst of the racial reckoning following George Floyd's murder that May. What began as a conversation about square footage and circulation became something larger: how a building could honor Black students and leaders and give voice to those long unheard. Maryland's oldest HBCU wanted a facility that celebrated that legacy while preparing students for an uncertain future.

The result was the **Martin Luther King, Jr. Communication Arts and Humanities Building**, which opened in Fall 2024. The 192,000-square-foot structure has become BSU's most-used academic facility, uniting media, the performing arts, and the humanities—inspired by Dr. King's charge to "have the courage to face the uncertainties of the future."

For this project, Mueller Associates provided mechanical and electrical engineering as part of a design-build



The 1,500-seat auditorium (top), is wrapped inside the building's sound-wave façade. In a technology-rich active-learning classroom (bottom), quiet, adaptable systems keep pace with collaborative, connected instruction.

partnership with the Whiting-Turner Contracting Company and Perkins&Will, tailoring systems to the exacting demands of broadcasting, recording, and performance.

The building is located between the campus' commuter rail station and its core: a deliberate statement of the University's commitment to communication and culture. Its signature feature wraps the auditorium like a frozen echo: an undulating façade derived from the actual sound waves of Dr. King's 1964 Nobel Peace Prize acceptance speech, its cadence translated into a pattern that rises and falls across the exterior.

The building's defining engineering challenge revolved around silence. Its television studios, radio stations, recording labs, and 1,500-seat auditorium all had to be sealed against noise—including from the systems conditioning them. Conventional ductwork moves air fast enough to raise a low-frequency whoosh: unnoticed in a classroom, but an unbearable rumble on a microphone tuned to a whispered line or a violin bow. Mueller's variable-air-volume systems slow that air to acoustically imperceptible levels, isolate the studios with independent air-handling, and set pumps, chillers, and air handlers on spring isolators, neoprene pads, and inertia bases—no vibration reaches a live take. Even at full cooling load, the auditorium maintains noise levels below the thresholds that professional performances demand.

Every BSU student will pass through this building, and every space they use—recording booth, lecture hall, auditorium, amphitheater—rests upon systems designed to disappear. By helping the building perform quietly and efficiently, Mueller translated Dr. King's belief in progress through education into brick, glass, and conditioned air—engineering that advances the mission by remaining nearly invisible.



CHAPTER 14

Beyond the Horizon

Over eighteen months, from mid-2024 to early 2026, Mueller Associates' evolving portfolio traced the arc of a firm approaching its 60th anniversary. At Towson University, students entered a new College of Health Professions in the Fall of 2024, its simulation suites and research laboratories held at precise conditions by systems no occupant would ever notice. Months later, in January 2025, George Mason University's Life Sciences and Engineering Building opened in Manassas, Virginia, where tissue engineers worked down the hall from robotics students. By Fall of 2025, Mason's 11-story Fuse at Mason Square—its street façade sheathed in power-generating solar panels—welcomed its first researchers to downtown Arlington.

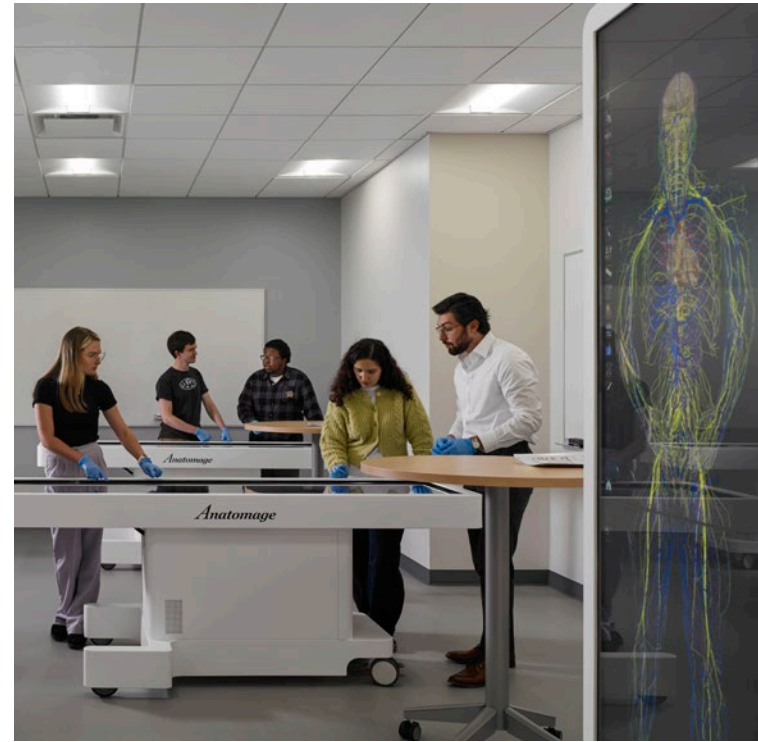
Behind those completed buildings stood dozens more still on the boards: the Smithsonian's Udvar-Hazy Center expansion, Virginia Tech's carbon-neutral engineering hall, UMD's adaptable Health and Human Sciences Complex, and the Northern Virginia Science Center, where interactive exhibits and flexible learning spaces will advance informal STEM education. Together, they embodied a single enduring idea: that the best engineering disappears into the human purposes it enables.



ENGINEERING ENVIRONMENTS INSPIRING HEALTHCARE EXCELLENCE: TOWSON UNIVERSITY'S COLLEGE OF HEALTH PROFESSIONS

For decades, Towson University's **College of Health Professions** had made do with a 1960s building that had long outlived its usefulness, its programs scattered across the campus. Yet the University enrolls more bachelor's- and master's-degree students in health care and wellness than any other institution in Maryland, preparing clinicians in physical therapy, occupational therapy, nursing, speech-language pathology, and physician assistance. When the University committed to a new 240,000-square-foot home, it was re-imagining how healthcare education could be delivered—and it handed Mueller, working as mechanical and electrical engineers, alongside Perkins&Will and JMT Architecture, an unusually demanding commission.

The building's program reads like a catalog of competing requirements. Ten specialty teaching labs, ten patient-exam rooms, eight acoustically isolated speech and audiology research labs, and six simulation suites, each demanding its own climate. Simulation suites had to hold steady temperatures, despite heat-generating equipment and varying occupancy; research labs needed conditions stable enough to protect sensitive instruments; speech and audiology testing laboratories required acoustical and air separation never needed in ordinary classrooms. "Every system was designed with flexibility in mind," said Clark Davenport, Mueller's project manager, "capable of adapting as instructional methods and technologies evolve."



Inside Towson University's College of Health Professions, students practice on high-fidelity mannequins and explore anatomy on digital tables, while independent HVAC zones hold conditions steady and unseen.

Mueller's answer to these challenges was a hybrid HVAC system that carved a single building envelope into independent environmental zones, each optimized for its specific function, while also contributing to the whole. Dedicated outside-air systems, paired with fan-powered terminal units, served the densely occupied classrooms and labs; a dedicated heat-recovery chiller captured waste heat from cooling and reused it for heating—an efficient strategy well suited to Maryland's cold winters and humid summers. Because the simulation mannequins, diagnostic equipment, and recording systems could not simply go dark in an outage, Mueller engineered an emergency power-distribution system to keep critical functions intact.

A first-year student crossing the light-filled atrium, glimpsing classmates through glass as they practiced patient transfers, would notice none of it—not the air-handling units, not the zoning, not the emergency power standing ready. That invisibility was the point. What students could see—and experience—was a building designed to support collaboration, confidence, and hands-on learning.

Since opening in 2024, the College of Health Professions has gathered five of the University's six disciplines under one roof for the first time in its 50-year history, giving Maryland's future clinicians a place to build confidence before they ever meet a patient.

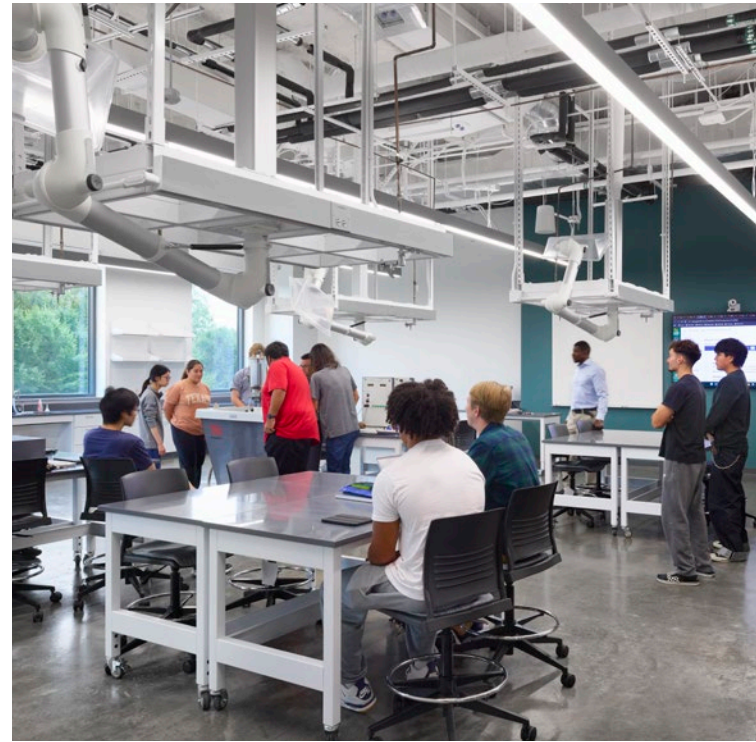


WHERE INSTRUCTIONAL INNOVATION MEETS HANDS-ON LEARNING: GEORGE MASON UNIVERSITY'S LIFE SCIENCES AND ENGINEERING BUILDING

On George Mason University's SciTech campus in Manassas, at the heart of Virginia's technology corridor, demand for engineering and life-sciences graduates had outrun the space to train them.

The University's answer—the 133,000-square-foot, four-story **Life Sciences and Engineering Building**—discarded the usual departmental floor plan in favor of a typology-based design, organizing space by the kind of work it hosted, rather than the University that owned it. Students from four colleges—Engineering and Computing, Science, Education and Human Development, and Visual and Performing Arts—would share it.

For Mueller Associates, working with the architecture firm Stantec (formerly EYP/Page), the puzzle lay in that very diversity. A single floor might have biology students pipetting enzyme solutions that tolerate no drift in temperature, mechanical engineers running heat-throwing machinery in a two-story fabrication bay, and kinesiology researchers filming subjects in a motion-capture studio requiring vibration isolation and controlled light. On the floor above, there could be engineers working with cultured cells that could be destroyed by the slightest fluctuation. Wet labs, dry labs, cadaver suites, clean rooms, and advanced-manufacturing spaces each carried distinct requirements for ventilation, power, and environmental control.



From wet labs and cadaver suites to motion-capture studios, clean rooms, and two-story fabrication bays, Mason's Life Sciences and Engineering Building houses a remarkable range of spaces, each served by systems tuned to its own exacting needs, and designed to support interdisciplinary teaching, research, and discovery.

"This building shows how flexible, innovative engineering can adapt to changing academic needs," said Daniel Carmine, who led the Mueller team. The firm's engineers designed systems to anticipate the next generation of demands, not merely present needs. Eleven specialty exhaust fans and six custom rooftop air-handling units—accessible through walkable service corridors wide enough for technicians carrying tools—allow staff to reconfigure and upgrade the systems without disturbing the work below. A heating-and-cooling plant comprising high-efficiency chillers, an energy-recovery chiller, and condensing boilers exceeding 90% efficiency responds to the building's varied loads while recapturing waste heat during the swing seasons.

From the outside, the result appears as pure transparency: ground-level laboratories face the campus path, allowing passersby to watch students build a Formula SAE race car or test a drone's autonomous flight.

Since opening in January 2025, the building has become a center for the interdisciplinary exchange it was designed to foster—its sophisticated infrastructure maintaining ideal conditions in each space while drawing no attention to itself.



FROM BOLD IDEA TO TOWERING REALITY: GEORGE MASON UNIVERSITY'S FUSE AT MASON SQUARE

Fuse at Mason Square represents something unprecedented in both ambition and design. Rising 11 stories in downtown Arlington, Virginia, it was conceived to dissolve the wall between the University and industry—to put graduate students, faculty researchers, and corporate partners in the same building, on the same floors, in deliberate proximity. Northern Virginia had become one of the nation's densest concentrations of technology talent, yet demand for that talent outstripped supply, threatening the very growth that produced it. Mason's remedy was audacious: a place where academic discovery and commercial application could happen under one roof, and where collaboration would arise not by mandate, but by design.

The project's delivery structure proved as novel as the purpose. Fuse was realized through a public-private partnership (P3) between Mason, the Commonwealth of Virginia, and private industry, with a Mason Innovation Partners team—Edgemoor Infrastructure & Real Estate, Clark Construction Group, and Stantec (formerly EYP/Page)—engaged to design, build, finance, operate, and maintain the facility. This partnership structure made the \$250-million investment possible—and it demanded close coordination among stakeholders with very different priorities. Designing Fuse's electrical and plumbing systems, Mueller had to serve a building infrastructure resilient enough for advanced computing, artificial intelligence, and cybersecurity work.

Neighborhoods Fostering Collaboration

Rather than stacking academic floors above corporate ones, the building's architects organized Fuse into "vertical neighborhoods" linked by "Main Street" corridors running through all 11 stories. Twenty-four specialized laboratory modules support work ranging from robotics and visualization to human-subject research. Classrooms, incubator spaces, retail, and gathering areas complete an ecosystem in which students, researchers, entrepreneurs, and industry partners share the same infrastructure.

Adaptable Electrical Infrastructure

The complex combination of spaces placed extraordinary demands on the building's electrical systems. "Fuse represents the convergence of technology, academia, and community," said Pathros Cardenas, Mueller's chief electrical engineer. "Every system was engineered for adaptability and resilience, ready to meet evolving power, data, and sustainability goals, while maintaining a seamless user experience." Advanced computing and AI research require not only heavy power but exceptionally clean power—stable voltage, harmonic control, protection against the surges that corrupt data—while robotics and cybersecurity labs each impose requirements of their own.

Mueller's solution centered on plug-in busways: prefabricated distribution runs that allow equipment to tap power at any point along their length. This approach reduces feeder cross-sections by nearly half against conventional design, freeing capacity and cutting installation time. But, the design's real value is flexibility. As labs are reconfigured and new equipment arrives, power can be drawn exactly where it is needed, without renovation. Daylight-responsive lighting, occupancy sensors, and multi-level smart metering trim

consumption further, feeding real-time data to dashboards, allowing operators, researchers, and tenants to study the building's own performance.

Plumbing for Conservation

The building's plumbing design, led by Karen Schulte—who also served as Mueller's project manager—pursued the same balance of efficiency and resilience. "From the earliest design phases," she said, "our goal was to ensure that the plumbing infrastructure could meet the building's intensive demand profile and maintain sustainability performance."

Where a conventional building loses heat by pushing hot water through long recirculating loops, Mueller's design distributes small electric water heaters near the points of use, all but eliminating those losses. Paired with low-flow fixtures, this strategy cuts indoor water use by around 41% against baseline. A condensate-harvesting system captures water shed by the air-handling systems and redirects it to irrigate the building's green roofs, sparing potable supply. Redundant backflow preventers, booster pumps, and sump systems help maintain service when individual components require maintenance or fail. Critical pumps are also monitored through the BAS and connected to emergency power.

The stormwater system reveals how far Mueller was willing to go beyond code requirements. Rather than simply meet the minimum, Mueller's engineers designed for a rainfall rate of 4.4 inches per hour—37.5% above the Virginia Plumbing Code requirement for the neighboring Washington, D.C., area—based on the reasoning that codes written using historical weather data may not reflect the storms that climate models project for the decades to come. An independent overflow-drainage system provides a second path off the roof if the primary system becomes obstructed.



A Façade That Generates Power

Fuse's most striking feature is the one visitors can actually see: a façade that produces electricity.

Developed jointly by Stantec's architects and Mueller's electrical engineers, the vertical array sets angled solar panels into the curtain wall along the building's primary elevation, generating power while still admitting daylight. This integration solves several challenges at once. Wiring runs through custom aluminum channels hidden beneath the façade's fins, protected from Northern Virginia's weather, yet reachable for future repair. In addition, each panel's cabling enters the building through curtainwall penetrations that, detailed poorly, could leak. And the whole assembly holds electrical continuity and weathertight integrity through wind pressures exceeding a hundred miles per hour, and the daily expansion and contraction of its materials. These measures, along with many others, helped Fuse earn LEED Platinum and FitWel 2-Star certification, making it one of the most sustainable academic buildings in the Mid-Atlantic.

When Fuse opened in the Fall of 2025, it began at once to do what it was built for: hosting competitions, housing early-stage research-and-development companies, and bringing students, faculty, and corporate partners into the informal contact that can foster collaboration. Its flexible power, water conservation, resilient design, and power-generating façade all operate invisibly beneath the visible pursuit of discovery.

Fuse's most visible feature is also its most functional: a curtain wall of angled photovoltaic panels that generates power, while admitting daylight—engineering in plain sight.

ON THE BOARDS: ENGINEERING MUELLER'S NEXT CHAPTERS

In January 2026, as Mueller entered its 60th anniversary year, its engineers were already shaping projects that would open years into the future: museum expansions, historic renovations, and new STEM buildings. Some extended relationships spanning decades; others marked the beginning of new partnerships. Collectively, they pointed toward the firm's next chapters.

Advancing Smithsonian Excellence

Mueller's decades-long relationship with the Smithsonian Institution continues with the expansion of the **Steven F. Udvar-Hazy Center** in Chantilly, Virginia. The project is expected to add 44,000 square feet to the Boeing Aviation Hangar, increasing its size by 20%, creating space to display major aircraft and other artifacts currently in storage.

Led by Ayers Saint Gross, with Mueller providing mechanical, electrical, and plumbing engineering, the expansion represents the first major construction and physical change to the Center's public areas since it opened in 2003. The project draws upon Mueller's extensive knowledge of the Smithsonian's facilities and collections-preservation requirements, while addressing the complexities of keeping the Center open during construction. Completion is anticipated at the end of 2028.

Pioneering Climate-Forward Engineering

At Virginia Tech's main campus in Blacksburg—Mueller's first project at the University—the firm is engineering **Mitchell Hall**, a 300,000-square-foot building that upholds the

school's pledge, adopted in 2020, to reach carbon neutrality by 2030. That timeline demands not incremental gains, but a rethinking of how a building uses energy, and Mitchell Hall is meant to serve as a proving ground for approaches that can spread across the campus and beyond. Designed by Perkins&Will, it will provide 70% more usable space within the same footprint, while becoming the largest building in the University's College of Engineering.

Mueller's engineering design uses chilled-beam technology, coupled with dedicated heat-recovery chillers, which allow the building to generate heat electrically, and even export "free" chilled water to the campus in the process. By heating with electricity instead of fossil fuels, and recovering waste heat from cooling, the system sharply cuts the building's carbon footprint, while maintaining the conditions required by its wet and dry labs. Transparent labs and exposed systems turn Mitchell Hall itself into a teaching tool. Scheduled for completion in 2028, Mitchell Hall also preserves the University's Stability Wind Tunnel—one of the largest university-owned wind tunnels in the country.

Transforming STEM and Arts Education

Three projects in design and construction further extend Mueller's expansive record in STEM and arts education.

At the University of North Carolina at Chapel Hill, Mueller is providing mechanical, electrical, plumbing, and fire-protection engineering for **Carrington Hall**, a 119,000-square-foot renovation and addition to the building that has housed the University's School of Nursing



Mueller continues to advance sustainable building-systems solutions. At Virginia Tech's Mitchell Hall (left), chilled-beam technology delivers precise climate control, while dramatically reducing the building's carbon footprint. Towson University's Smith Hall (right) benefits from the University's first geothermal system.

since 1969. Led by Ayers Saint Gross and Little Diversified Architectural Consulting, the revitalized Carrington Hall centers on flexibility: an Education Innovation Simulation Learning Environment, research space, and common areas organized, per UNC's strategic plan, around the themes of Connect, Hub, and Welcome.

At Towson University, Mueller's engineers are recasting a former science building, **Smith Hall**, into a 200,000-square-foot home for the University's Mass Communication, Communication Studies, and Electronic Media and Film programs, along with the Faculty Academic Center of Excellence. Under JMT Architecture and Shepley Bulfinch, the project introduces Towson's first geothermal system: ground-source heat pumps circulating fluid from a well field beneath the campus quad to Smith Hall—an early marker of the University's push toward carbon neutrality.

At the University of Maryland, College Park, Mueller is designing the mechanical and electrical engineering systems for the **Health and Human Sciences Complex**, a 160,000-square-foot conversion of core-and-shell buildings into a facility for the nation's top-ranked School of Public Health. Led by the design-build team of Clark Construction and Stantec (formerly EYP/Page), the project supports both wet and dry laboratories, specialized fume extraction, and modular utility distribution that can be reconfigured as research methods evolve.

Inspiring the Next Generation

In Loudoun County, Virginia, Mueller is providing mechanical, electrical, plumbing, and fire-protection engineering for the **Northern Virginia Science Center**, the region's first dedicated interactive science museum. Developed through



The Health and Human Sciences Complex at the University of Maryland, College Park, transforms core-and-shell buildings into a home for the nation's top-ranked School of Public Health, its wet and dry labs served by systems built to reconfigure as research needs evolve.

a partnership between the Children's Science Center, the Science Museum of Virginia, and Loudoun County—and designed by the architecture firm HGA—the 65,000-square-foot facility will hold more than 35,000 square feet of interactive exhibits alongside classrooms and flexible learning spaces. Mueller's engineering systems are built for heavily programmed exhibits, rapid visitor turnover, and continual reinvention as displays and technology change. When it opens in 2027, the Center is expected to draw more than 300,000 visitors a year, positioning an already formidable technology region as a hub for informal STEM learning and hands-on scientific discovery for all ages.

Beyond the Horizon

Six decades in practice have given Mueller something that cannot be built quickly: a portfolio diversified across sectors,

geographies, project types, and funding sources. Entering 2026, the firm's backlog extended across universities and federal agencies, state governments and cultural institutions, new construction and historic renovation. That breadth provided a measure of resilience few single-market firms could match: when one sector slowed, another sustained momentum; when one funding source tightened, others remained. Despite economic headwinds—including tariffs, uncertainty surrounding federal spending, and broader market anxiety—Mueller entered its 60th year well positioned for what lay ahead.

The breadth is easiest to see in the roll call. In higher education, Mueller is at work on renovations at Georgetown University's Lauinger Library; the Ellicott and Hagerstown Halls at the University of Maryland, College Park; Morgan State University's Carter-Grant-Wilson building; and



The region's first dedicated interactive science museum, the Northern Virginia Science Center, is expected to welcome more than 300,000 visitors annually to spaces engineered to adapt as exhibits, technologies, and educational programs evolve.

Sherman Hall at the University of Maryland, Baltimore County. It is designing systems for the Hilda C. Landers Library and Montgomery Hall at Saint Mary's College of Maryland; two projects at the medical campus of Northern Virginia Community College; Radford University's Dalton Dining Hall and a new 360,000-square-foot health-sciences building on the University's Roanoke, Virginia, campus; and Bowie State University's new 185,000-square-foot Thurgood Marshall Academic Commons and Library.

Among cultural institutions, Mueller's work includes the U.S. Botanic Garden's Production Facility and Learning Center Complex; the Pennsylvania State Museum and Archives in Harrisburg; the Washington County Museum of Fine Arts in Hagerstown, Maryland; the Frontier Culture Museum's American Journey Gallery in Staunton, Virginia; the comprehensive renovation of the Library of Virginia in Richmond; and the new Farrand House at Dumbarton Oaks

in Washington, D.C. Larger still are the Virginia Department of General Services' 350,000-square-foot Annex Tower—the agency's largest project to date—and a study and renovation of the West Virginia Culture Center in Charleston: a 1976 building whose systems and envelope require replacement, much as those at the National Air and Space Museum did.

As these projects move from design and construction to completion and occupancy, they carry forward the principles that have guided Mueller Associates since 1966, across changing technologies and generations. The firm's founders could not have foreseen the chilled beams, ground-source heat pumps, building automation, and power-generating façades these buildings employ. But they would surely recognize the commitment beneath them: engineering that serves human purposes, supports institutional excellence, and demonstrates real technical mastery, while drawing as little attention to itself as possible.



CHAPTER 15

Voices of Mueller

The best engineering, Richard Mueller believed, should be invisible. Not because it does not matter, but because it matters so profoundly that, when properly conceived and executed, it allows museums, concert halls, laboratories, and other buildings to fulfill their highest purposes without anyone noticing the systems that make those purposes possible.

For six decades, Mueller Associates has pursued a philosophy of excellence through invisibility—engineering that disappears into the experiences it enables. But behind every invisible system stands very visible people: engineers who have dedicated their careers to solving problems most will never see, to preserving artifacts that will outlast us all, and to creating environments in which discoveries happen, performances resonate, and communities gather.

As Mueller Associates celebrates its 60th anniversary, these voices—spanning generations, disciplines, and thousands of landmark projects—reveal what it means to do difficult work well.



Mechanical Project Engineer Paul Czajkowski confers with a young Matt Velky, then a mechanical engineer, at Mueller's new Linthicum office in 2016. A decade later, Paul would serve as senior chief mechanical engineer, and Matt as project manager. Mentoring future leaders is embedded in Mueller's culture.

The Accidental Engineers

Not everyone arrives at engineering via a straight path. Some of Mueller's most accomplished engineers discovered their calling through unexpected doors, proving that passion often matters more than pedigree.

Paul Czajkowski's journey began as far from engineering as imaginable. "I wanted to be a carpenter since age nine," he recalls. "I didn't study math or science in high school. I went on a vocational track."

After working in a custom millwork shop in high school, Paul had no plans for college. His father persisted, eventually convincing him to at least look at community colleges. "My father grabbed a phone book and called the local community college, wrote on a yellow notepad all

the curricula they offered, and brought that home," Paul remembers. Looking at his father's list with teenage indifference, Paul said, "Maybe I could tolerate this architectural and engineering design thing." What followed were years of remedial coursework. Paul completed the math and science courses he had skipped in high school, before taking "real" engineering classes. After one year of community college, he mailed application letters to 30 engineering firms in the Baltimore metropolitan area—29 of which were to civil and structural engineers. One went to Mueller Associates, but only because their office was 10 minutes from his house. "I didn't understand what Mueller did," Paul admits. "After the interview, I didn't understand it much better."

But Mueller Associates saw something in the young draftsman. In 1980, Paul began a summer job that transitioned into a career at the firm, lasting 46-plus years. From draftsman

and designer to mechanical engineer, from project engineer to chief mechanical engineer, and now senior chief mechanical engineer, Paul's unlikely journey embodies Mueller's commitment to developing talent. "It's been a long, exciting, and satisfying journey to go from knowing absolutely nothing about mechanical engineering, to a combination of training in school and learning on the job while doing," Paul says proudly.

Keirstin Hughes, mechanical project engineer, arrived at engineering through a different kind of uncertainty. "When I applied to college, I had no idea what I wanted to do," she says. "I chose to start in an 'engineering undeclared' program to get exposed to the many disciplines. Mechanical was my favorite of them, so I continued down that path."

Eight years into her career at Mueller, after graduating from the University of Delaware and working on projects ranging from George Mason University's Life Sciences and Engineering building to various facilities at the Smithsonian Institution, Keirstin reflects upon her choice with satisfaction: "Today, I'm grateful that it led me to the construction industry. I use my 'classroom' knowledge of math and physics to create real-life things. I'm the only engineer in my family. It's cool to teach them about everything I've learned, and what an engineer really does."

Christopher Hodges, mechanical project engineer, found his path through pure accident. "My interest in the A/E industry was sparked completely by chance, starting with my first internship at a local manufacturer's rep," he says. "When exposed in tandem to concepts such as thermodynamics and heat transfer in school, I found myself having a strong affinity for learning more about HVAC systems." Now having worked on projects such as the Bowie State University's Martin Luther King, Jr. Communication Arts and Humanities

building, the National Museum of Women in the Arts renovation, and the Smithsonian Bezos Learning Center—Chris has found his calling. "The best aspects of my job at Mueller are easily the notoriety and prestige of the work that we receive, which in turn inspire me to do my best work and contribute beneficially to society and culture through my passion for engineering and design."

Whether they arrived by chance, circuitous routes, or family tradition, these engineers found something at Mueller worth staying for. The firm that gave Paul Czajkowski an opportunity in the early 1980s is the same company where he will finish his career, passing along the systematic training methodology he has developed. "What's very satisfying is to see people that I mentored when they first came to Mueller. They came in, they developed, they grew, they rose beyond my level at the time, becoming project managers," he reflects. "The beautiful thing about it is not only seeing them develop, but also how they thrive and mentor others."

Culture That Sustains

Buildings may define Mueller's portfolio, but people define its culture. Again and again, engineers who have spent decades at the firm point to the same qualities: accessible leadership, continuous learning, and a mentorship tradition that transforms knowledge into institutional wisdom.

Bob Marino arrived at Mueller in 1986, fresh from Penn State's Architectural Engineering program. His first major project—the National Museum of Women in the Arts (NMWA)—paired him with Gene Nerf, who was then vice president. "I was a green engineer, and Gene just kept saying, 'I need help. I need help,'" Bob recalls. "It was a perfect opportunity for me, because I immediately got thrown into what I love to do." That project became Bob's foundation.



Mechanical project engineers Keirstin Hughes (left) and Thea Postolache (right) review a drawing set: the everyday collaboration is the real foundation of Mueller's success.

"Having Gene as a mentor accelerated my career, because I learned so much in just those first two years working on that project. And to this day, it's my favorite project." That relationship extended far beyond technical training. "Gene became not only a mentor, but a friend of mine for decades."

Steven Gillis, now senior vice president with nearly four decades of experience at Mueller, echoes this emphasis on people over projects. "When you come to Mueller, the leadership that's in place is always trying to grow new leadership, and we've done it successfully for several generations." The firm's commitment to remaining small enough for everyone to stay connected is deliberate. As Gillis notes, "We're looking to remain a small firm where everyone is accessible to every person in the firm."

This accessibility is not just theoretical.

Thea Postolache, a mechanical project engineer who joined Mueller in 2018, describes the reality: "Everyone at Mueller is extremely accessible and enthusiastic about sharing their experiences and guiding one another through tasks and challenges." She specifically notes that "everyone's door, from the project managers to the president of the company, is always open."

Growing up as the second of five children, Thea learned early on that "working together we could accomplish anything we set our hearts and minds to." She found that same collaborative spirit at Mueller. "What excites me about working in our industry is that we get to collaborate with talented individuals from many different backgrounds and

disciplines. Leveraging everyone's strengths and effective communication, we create amazing built environments that diverse groups of people can enjoy."

The culture that Mueller's founders established continues to attract engineers seeking more than employment. "Mueller's greatest strength is its people," Tom Syvertsen declares after more than two decades at the firm. "You could say it's the portfolio of our work and experience, but without the people, the portfolio doesn't mean much. The portfolio gets you future work, but only because people are there who can deliver. It's the people and their knowledge."

Ken Rock, who retired as a senior vice president at the end of 2021 after nearly 37 years with Mueller, traces that longevity to principles established by Richard Mueller. "The things that kept me there were these foundational principles of the firm: hiring great people, working for interesting clients, and always looking for challenging work," he reflects. "Growing up with the people you started with, watching them develop professionally as you did, and going through changes in their personal lives—it is more than friendship; it's almost like family. It's special."

This culture of mutual investment leads to remarkable career longevity. Clark Davenport and Tom Syvertsen offer perhaps the most unusual example. Childhood friends from central Vermont who attended Messiah College in Pennsylvania and roomed together for three years, both built their careers at Mueller—Tom joining in 2002, and Clark in 2003.

Museums: Preserving the Irreplaceable

Museum work requires engineers to think beyond human comfort to consider artifact preservation, balancing the needs of historical objects with those of contemporary

visitors and operational costs. It is engineering at its most exacting, where a few degrees or percentage points of humidity can mean the difference between preservation and degradation.

Daniel Carmine, a senior project manager and mechanical engineer, has spent more than 30 years mastering the unique challenges of museum work. At the Smithsonian National Zoo, however, Dan has faced challenges beyond typical museum work. "The biggest concern that you have with these projects is that you have to understand what the climate is that those animals need." For the Giant Panda smoke-evacuation system and the historic Bird House renovation, protecting animals required an understanding of their instincts and requirements. "You have to make sure that you understand, before you start anything, that your primary goal is protecting those animals."

This demands a particular kind of engineering diplomacy. "When you're in a room talking about aesthetics and how things look," Dan says, "you have to make sure that you don't let any of those voices pull you away from your ultimate goal, which is protecting the health and well-being of the animals." His approach: "You have to try to come off, not as combative, but as a learning tool. You have to come off as a teacher, and give everyone the understanding of where you're coming from, and the reasons, and why you're doing certain things."

Rebecca Fischer has spent nearly two decades navigating these complexities, as both a mechanical engineer and a project manager. Since joining Mueller in 2004, she has led some of the firm's most challenging museum renovations, including the Smithsonian's National Air and Space Museum, NMWA, and the National Academy of Sciences: historic buildings with intricate architectural and engineering

requirements. “Many of our projects are either open to the public, such as museums, or heavily used by students at universities,” she notes. “It’s an amazing feeling to visit the buildings we have designed after they are in use, and see how visitors enjoy them.”

Karen Schulte discovered the complexity of museum work through the Smithsonian National Zoo’s Bird House. This project required thinking beyond human needs entirely. “The Bird House is a museum. But the inhabitants are birds, not artifacts,” she notes. “We had to keep that in mind for the entire project—both from a plumbing perspective and HVAC—that we weren’t designing this for people to live in. We were designing it for the birds.”

Invisible Systems Behind the Scenes

If museum work demands precision, performing arts facilities demand perfection. A whisper of air, a barely audible hum, a slight temperature variation—any of these can destroy performances for which artists have spent months preparing and perfecting.

Tom Syvertsen has spent much of his career mastering this challenge. “The engineering of these different types of performance spaces is really about not being seen or heard,” he says. “It’s essential in performances where you might have an actor delivering dialogue, or a soloist playing the violin onstage. We don’t want to crowd out those performances with our ambient noise.”

He shares an acoustician’s adage that embodies the stakes: “As a performer is trying to find their voice, you need to provide an excellent acoustical environment in which they can do so. Once they’ve found their voice, they can perform on a street corner or a subway platform, but until then, they

need that excellent acoustical environment. And we strive to create that environment for them.”

At Capital One Hall, Clark Davenport faced the challenge of achieving absolute acoustical silence in a 1,600-seat venue. The solutions required extraordinary coordination between architectural, structural, and MEP systems. When Clark attended a concert at Capital One Hall shortly after it opened, he experienced the design he had overseen as an audience member. “I took my seat. As the show was starting, it got really quiet, and I was just trying to hear any fan noise or any air movement. I really couldn’t. I was pleased by that, because it meant that the systems we designed were working as intended. I was very comfortable, too.”

The Smithsonian Partnership Endures

If any client relationship reflects the enduring philosophy of Mueller Associates, it is the firm’s partnership with the Smithsonian Institution. From its earliest work in the 1970s through the modernization of the National Air and Space Museum and the ongoing development of the Bezos Learning Center, Mueller has helped the Smithsonian maintain, upgrade, and reimagine its constellation of museums and facilities.

Todd Garing’s involvement with the National Air and Space Museum revitalization project spans a large portion of his career. “I have been involved with this project since 2013,” he notes, although Mueller had completed numerous smaller assignments in the building long before the comprehensive modernization began. That institutional knowledge—and the firm’s commitment to the Smithsonian’s long-term interests—proved valuable when the Museum considered replacing all of its steam piping. Mueller advised against the initial investment, anticipating that the piping would soon

be removed as part of the larger renovation. “We said, ‘We know that this major project is coming. If you spend millions of dollars to replace this piping, and then five or ten years later it’s going to be removed, it just doesn’t make sense.’” Garing recalled the decision with evident pride: “We actually convinced them not to do that project.”

The technical challenges of the Air and Space Museum project matched its extraordinary scale and complexity. “We found out,” Garing explained, “that the large atriums are actually really bad for artifacts, because the temperatures in the upper half of each were very, very high, and that’s where all the artifacts—all the planes—are hung from.” Mueller used computational fluid dynamics modeling to study airflow and identify the optimal placement of supply-air diffusers. “Through an iterative process of placing diffusers in different locations and studying the existing data, we were able to get the temperature fluctuation within a fairly tight window,” Garing adds.

Pathros Cardenas, Mueller’s chief electrical engineer, faced unprecedented challenges on this same project. His 13 years of involvement taught him lessons applicable throughout his career. “People’s safety come first,” he says. He describes success in characteristic engineering terms: “A measure of success is whether the client complains about the finalized building. If no one’s complaining, you’ve done your job very, very well.”

Nearly every Mueller engineer has gained experience through Smithsonian projects. Continuing that tradition, the firm’s newest engineers have contributed to assignments ranging from feasibility studies and small-scale renovations to the new Bezos Learning Center and the expansion of the Udvar-Hazy Center. The Mueller-Smithsonian relationship, established in the firm’s earliest years, remains both a

cornerstone of its practice and a training ground for successive generations of engineers.

Know Your Foundations

Beneath Mueller’s range of projects lies a consistent philosophy rooted in a way of thinking about engineering that gets transmitted from generation-to-generation through mentorship, systematic training, and a shared commitment.

Paul Czajkowski has become one of Mueller’s keeper of engineering fundamentals. After learning “the hard way,” he has spent recent years—decades even—codifying best practices into systematic design tools: “You need to understand and be well-versed in the foundations and fundamentals,” he says. Paul’s systematic approach now encompasses 27 tools. But more important than the tools themselves is what Paul calls “passing it on”—engineers he mentored are now mentoring others using these same principles. “This is a growing embodiment of a systematized design foundation that I hope to leave as a legacy when I retire.”

Paul’s approach emphasizes understanding principles, rather than memorizing procedures: “No matter how we do this, whether it’s by manual calculation, in-house computer-based, or a manufacturer representative’s selection, it has to work from the foundation up. Heat transfer, air flow, and water flow have to balance, and they need to make sense on a psychrometric chart.”

Adam Fry, a vice president leading Mueller’s electrical engineering team, echoes this emphasis on continuous learning. “I’ve been at this for more than 20 years. I’m always learning, and I always need to keep learning,” he says. “Continuing to hone the skills I have is important. And then imparting that philosophy to the younger engineers—that they need



Vice President Adam Fry reviews a design with electrical engineer Sela Plummer. The exchange across experience levels is how Mueller's methods pass from one engineer to the next.

to continue learning throughout their entire careers. It's not just the first few years that are the learning phase, and then they've arrived. Because you've never arrived."

Tom Syvertsen emphasizes the importance of exposing younger engineers to field conditions. "Things aren't really built in the virtual world," he explains. "You develop concepts and designs virtually, but ultimately, they have to be implemented in the real world." This field exposure teaches practical lessons no classroom can provide. "How do you actually mount a clevis hanger to hang a pipe?" asks Syvertsen. "You need space to do that." Understanding constructability, coordination, and the reality of installation transforms theoretical knowledge into practical wisdom.

However, technical excellence alone does not complete complex projects; engineers must also communicate clearly

with audiences ranging from facility managers and curators to university presidents.

Project Manager Matt Velky learned this during the early stages of the Smithsonian Hirshhorn Museum's revitalization.

Velky says, "What I learned working on that project is how to put Mueller's engineering solutions into a compelling presentation, how to make a spreadsheet that says exactly what my point is, and how to take all this data that we go through and put it into a single bullet point." Success, he explained, depends upon translating technical realities into the form each audience needs. "It's trying to manage the expectations of what the client is anticipating from us, while making sure that all the technical information is grounded in reality—and then transmitting the right messages to the right people and tailoring what we're saying to each party."

Pointing with Pride

Engineering's rewards often come not from recognition, but from the quiet satisfaction of seeing one's work enable something greater: a moving performance, a museum that preserves culture, a campus where discoveries happen.

Sherwayne Stoute, after more than 20 years at Mueller, still marvels at this aspect of the work. "Being able to drive through parts of Maryland, Washington, D.C., and Virginia, and point out buildings to my family and friends that I have worked on, to this day seems surreal," he reflects. "To know that you have played a part in building a university campus where our future leaders are being developed, or museums that I take my son to, brings some fulfillment to my everyday purpose."

Tom Syvertsen feels the same connection. "When I go to Washington, D.C., and walk through the National Air and Space Museum, which gets millions of visitors a year—everyone's looking up at all the planes and enjoying their experience. I had a part in that. I helped create that environment to preserve history and artifacts and provide visitors with that experience. That's something that gives me a lot of pride."

Michael Kowalski, a mechanical project engineer, finds particular satisfaction in the tangible impact of engineering. "It is gratifying to see your work being utilized in the field and know that it positively affects many lives," he said. That appreciation began during childhood and continues to shape his work today.

Justin Saelens, a mechanical project engineer, maintains the enthusiasm that drew him to engineering as a sixth grader, when he was fascinated by rollercoasters. "Growing up, it

was not unusual to find me with something in pieces in front of me, trying to figure out how it worked," he recalls. Now he applies that same curiosity to buildings. "Twelve years and two degrees later, nothing has changed, except that my passion for rollercoasters is even stronger!"

Mechanical Engineer Abbie La Porta finds satisfaction in the invisible nature of Mueller's projects. "I am always excited for the opportunity to work on unique projects, and to draw upon the experience of other engineers, and absorb all that I can. I love being able to do the work that people don't always see, but that keeps things running."

Chris Hodges articulates what draws many to Mueller. "The best aspect of my job at Mueller is easily the profile and prestige of the work that we receive, which in turn inspires me to do my best work and contribute beneficially to society and culture through my passion for engineering and design."

Doing Difficult Well

"Mueller does difficult well" has become something of a mantra at the firm—but what does it mean in practice?

Todd Garing, Mueller's fifth president, explained that the philosophy begins with understanding the project's true challenge. "'Mueller does difficult well' is really about understanding the actual challenge of a project," he said. "The first step is thoroughly understanding the owner's pain points: What are they trying to change? What do they want to accomplish when the project is complete?"

That process requires looking beyond stated requirements. "Standards are often quite old and may reflect something that happened 20 or 30 years ago," Garing continued. "You have to ask insightful questions."

Understanding the history behind a requirement can open the door to better solutions. “Once you understand what is behind it, you can explain what is available now and discuss whether another approach might make sense.”

Innovation, however, must remain practical. “We want to advance the systems only as far as the client feels they can maintain them,” Garing says. “We do not want to give them something they lack the staff or resources to operate successfully over time.” Doing difficult well, then, means balancing innovation with judgment: finding the most effective solution for the client, the building, and the people who will sustain it, long after the project is complete.

Tom Syvertsen sees this philosophy at work in performing arts projects, where numerous stakeholders often bring competing priorities. “A lot of the projects we work on are very complex, especially performing arts projects,” he said. “We try our best to meet those requirements, but we may also need to help stakeholders understand what is realistic and what can be achieved among the available options.”

The key to success? “Ultimately,” says Syvertsen, “they’re going to be running their facilities, and they have to maintain the buildings. They have to be comfortable with the solutions we develop. If we force a solution onto someone, they’re not likely to come back to us the next time.”

Ken Rock saw the result of that philosophy in the enduring relationships Mueller developed with clients such as Georgetown University and Wake Forest University Baptist Medical Center. “One of the things I enjoyed most about my career was working with clients over long periods of time,” he says. “They got to know you, gained confidence in your work, and kept hiring you back. They knew you were the right engineer, and they wanted you to keep coming back.”

The Next 60 Years

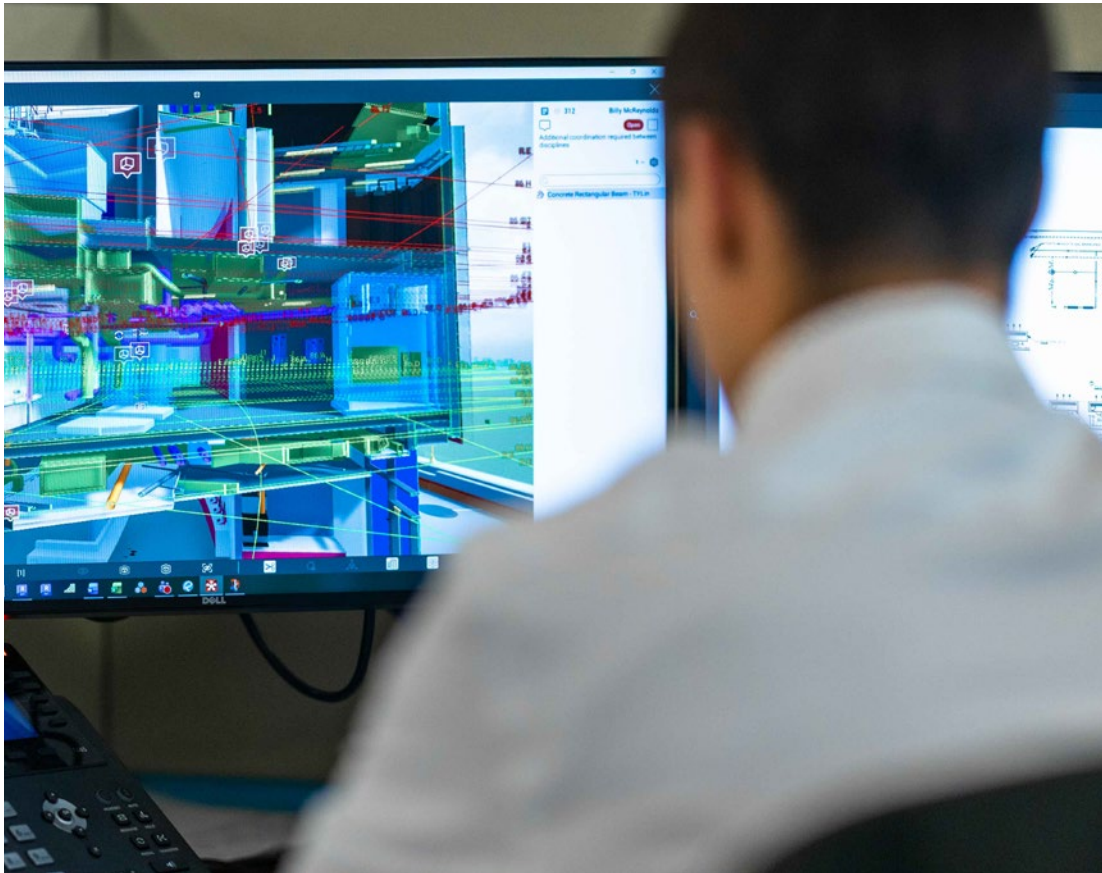
As Mueller marks its 60th anniversary, the question is not whether the firm will change, but how it will carry its founding vision into a changing world.

In August 2026, that future took physical form when the firm moved to 1201 Winterson Road, Suite 300, just one mile from its previous office. Height-adjustable workstations, enhanced collaboration technology, additional huddle rooms, and varied spaces for focused and shared work create a more adaptable workplace, reflecting the firm’s commitment to employee well-being and continued growth.

The relocation also advances a central goal of Mueller’s 2025–2030 Strategic Plan: becoming a Best Place to Work. More than a change of address, the new office represents an investment in the people who will carry the firm forward. It supports collaboration, mentorship, and the daily exchange of knowledge across generations—the culture that Mueller seeks to sustain as it grows.

For Todd Garing, renewal does not mean reinvention. “What I would like to ensure is that the next generation understands that we really haven’t deviated from our core since the founding of the firm. It’s about doing quality work and working on impactful projects that are also often difficult.”

The future therefore depends upon people who welcome those challenges. “Making sure that we have people who are up for the challenge—who like to be challenged—is important,” Garing says. The reward is work with a lasting purpose: “We’re preserving artifacts for the next generation. We’re creating labs where they could help cure cancer someday. We’re creating performance spaces where the arts can thrive and support the next generation.”



On his monitor, the systems a visitor will never see: Mechanical Project Engineer Aaron Rubin builds the Revit model for the Smithsonian's Bezos Learning Center.

Tom Syvertsen places that work in a broader context. “I would tell a young engineer that this industry is probably more important than they think,” he says. “People spend a tremendous amount of their time inside buildings, inside the comfort that our systems provide.”

Matt Velky, 12 years into his career, sees Mueller’s longevity as both an inheritance and a responsibility. “It’s incredible that we’ve had that longevity in the marketplace and the wealth of experienced people who have been here for 30-plus years.” Yet his generation must now help “chart a path forward—to continue that for the next 60 years” as leadership passes to “some fresh new faces.”

Mechanical project engineer Aaron Rubin captures the appeal of that responsibility: “I love being able to work on high-profile and complex projects. Each one presents unique challenges that require innovative, out-of-the-box thinking.” He also values the opportunity to meet those challenges as part of a trusted team.

That combination—meaningful work, shared knowledge, and trusted colleagues—is not merely why people remain at Mueller; it is how the firm renews itself without losing its identity. The next 60 years will be built as the first 60 were: one difficult project, one hard-earned lesson, one act of mentorship, and one generation of engineers at a time.

INVISIBLE EXCELLENCE

Museums that preserve.

Performance spaces that come alive.

Laboratories that lead to new discoveries.

Campuses that inspire.

Environments that enable rather than distract.

All supported by systems no one notices, because they work—flawlessly, continuously, sustainably. This is the paradox at the heart of Mueller’s work: its greatest success is measured by how completely the engineering disappears into the human purposes it makes possible.

Richard Mueller understood this philosophy six decades ago. He entrusted it not to buildings or technologies, but to people. The engineers whose words appear in this chapter—and throughout this book—have received that trust, tested it against new challenges, and passed it forward, each speaking in a distinct voice, but united in a common purpose.

They are the voices of Mueller—past, present, and future—carrying forward a culture of technical mastery, mentorship, judgment, and service.

The tools will change. The buildings will change. The challenges will change. But the obligations will remain the same: to do difficult work well for clients who entrust Mueller with what matters most.

No generation completes this work alone. Each receives knowledge shaped by those who came before, tests it against the demands of its own time, and passes it forward strengthened by experience.

What began as Richard Mueller’s conviction has become a shared inheritance—renewed whenever knowledge passes from one engineer to another, a team chooses stewardship over expedience, or a new generation accepts responsibility for sustaining it.

The work continues.

The knowledge is passed on.

The standards endure.

And each new engineer at Mueller discovers what it means to make the invisible excellent.



AFTERWORD

In Summer 2024, as Mueller Associates' management team prepared for a critical strategic planning session, I stood in the accounting department surrounded by rows of thick black binders. Most contained contracts, proposals, and invoices—the administrative skeleton of six decades in business. These particular binders, however, held something else entirely.

I opened the first one.

Inside, meticulously arranged in plastic sleeves, were hundreds of projector slides documenting Mueller's projects from the 1970s through the 1990s, each identified by carefully handwritten labels. The precision was striking: five-inch binders organized with the attention to detail any Mueller engineer would recognize—and appreciate. Here was physical evidence of work that had shaped institutions, preserved with the same deliberation that the firm brought to every building system, calculation, and mechanical, electrical, or plumbing and fire protection specification.

Then I opened a smaller binder.

Newspaper clippings. Old newsletters. Printed materials from the early 1980s. Documents that many members of Mueller's current leadership had never seen, containing stories they had never heard. The record continued through the 1990s and into the early 2000s, eventually giving way to the polished *Momentum* newsletters I already knew. But everything before—the foundational years, the periods of growth and expansion—had been sitting there, hidden in plain sight.

Press releases, client mailings announcing promotions, professionally printed brochures—countless pieces had been retained. The newsletters themselves remained remarkably crisp in their plastic sleeves, as though they had only recently left an early-1980s printing press. They were not casual updates. They were carefully produced records of the firm's people—milestone anniversaries, new hires, engineers passing their professional licensing examinations, and internal promotions—celebrated alongside major commissions and technical achievements.

Holding one of those newsletters, I was reminded of a time when company communications were physical objects, created to be read, retained, and, in this case, preserved. Someone had understood that these documents mattered.

As it turned out, one of Richard Mueller's secretaries had begun the collection, and another member of the administrative staff had continued it—organizing the materials chronologically, protecting each document in plastic, and keeping the firm's institutional memory alive even when no one was actively looking for it.

Among the materials, I discovered something especially meaningful: two pages of graph paper covered in Gene Nerf's handwriting. I had heard stories about Gene's penmanship—distinctive and unmistakable. Using what

appeared to be a mechanical pencil, he had listed his favorite projects in chronological order, year by year, through his retirement. It was a personal canon: one engineer's measure of meaningful work across a career. Holding those pages felt like discovering a map of the company's soul.

But, before I go further, I should explain something about myself.

I came to this industry by an unlikely path. After earning a Master's Degree in Liberal Arts from Johns Hopkins University, I once planned to pursue a doctorate in American History before turning toward marketing and communications. I had learned to translate technical work for broader audiences and to tell stories on behalf of organizations. The historian's training never left me; it simply found another application.

Standing in Mueller's accounting department, holding those newsletters and studying Gene Nerf's handwritten list, I felt something shift. Historians have often described the exhilaration of discovering forgotten primary sources—the sudden recognition that an overlooked collection contains an extraordinary story. This was such a moment, but it was also more personal: an unexpected convergence of the materials I had been trained to interpret and the position I now held within the firm whose history they recorded.

Here was an opportunity to return to what I had first set out to become: a historian and a writer, someone who could shape primary sources into a narrative that honored both the factual record and the people behind it. I had found my treasure trove. Or had it found me?

The materials themselves shaped the way I approached the work. The early newsletters included candid interviews with

Mueller's founders and leaders, revealing a degree of openness and detail rarely found in contemporary corporate communications. They spoke frankly about the challenges of growing a business, the philosophy behind opening new offices, and the reasoning that guided organizational decisions. These were not sanitized accounts of uninterrupted success. They were honest records of people building something, confronting uncertainty, and learning as they went.

That authenticity became my North Star. If Mueller's leaders had spoken honestly about their journey, I could honor that spirit by preserving its complexity and humanity. The archives did not simply provide information; they gave me permission to tell the history faithfully.

What emerged was a story I had not anticipated—and one that brought together nearly every part of my professional and intellectual life.

I expected to write about engineering achievements, and I did: the Smithsonian projects, the Kennedy Center renovations, the complex higher education partnerships, and Mueller's early work in sustainable design. But the archives revealed something even more fundamental and enduring beneath those accomplishments: Mueller's unwavering commitment to its people.

The newsletters celebrated engineers passing PE examinations with the same enthusiasm given to commissions and milestones. Interviews from the 1970s and 1980s devoted as much attention to mentorship, professional development, and career growth as to sophisticated building systems. Richard Mueller's founding vision was not solely about engineering excellence. It was about creating an institution where engineers could learn from one another, grow into leadership, and do the best work of their careers.

That investment in people made everything else possible: engineers capable of addressing a building's most difficult requirements, clients willing to entrust Mueller with irreplaceable collections and important institutions, and a transfer of knowledge that allowed younger professionals to learn directly from experienced practitioners. Even the preservation of the newsletters, slides, press releases, and handwritten pages reflected that culture. Just as Mueller's engineers designed systems to serve buildings for decades, the firm valued stewardship, attention to detail, and institutional memory.

In writing this book, I have tried to honor both the materials I discovered and my training as a historian. The discipline requires fidelity to primary sources, but it also asks the writer to find the human story within the record—to recognize that dates, specifications, and project names ultimately describe people making decisions, solving problems, accepting responsibilities, and building relationships.

David McCullough, one of my favorite historians and biographers, repeatedly emphasized that history is about people rather than abstractions, and that strong historical writing allows readers to experience events alongside those who lived them. That is what I have attempted throughout these chapters: to transform engineering specifications into human drama, reveal the thought and relationships behind Mueller's technical achievements, and make six decades of institutional history feel immediate and alive.

Whether I have succeeded is for readers to judge. What I do know is that the story remains true to the materials I found and to Mueller's culture of precision, integrity, and care.

A book like this is never a solitary act, and mine owes its earliest debts to Cindy Taylor. Beginning in the early

2000s, Cindy became the voice of Mueller, shaping its newsletters, press releases, website, and social media while gathering and preserving much of the material upon which this history draws. She also initiated the book's first draft, recovering conversations and anecdotes from interviews she had conducted across two decades. Her work became the foundation upon which this narrative was built.

I first met Cindy when I interviewed at Mueller on August 6, 2019, the day after my favorite writer, Toni Morrison, had died—a convergence of dates I have never forgotten. When I joined the firm later that September, Cindy taught me not only about Mueller, but also about an industry she had known for decades through her work with Quinn Evans, Dewberry, and many other firms. Most of all, she taught me how to listen and how to learn. For all of it, I am deeply grateful.

I am also indebted to Sheila Singhal, whom I met in Fall 2023 after joining the board of the International Association of Museum Facility Administrators (IAMFA) and becoming editor of its magazine, Papyrus. Sheila reviewed every chapter of this book with extraordinary care, offering thoughtful revisions and never hesitating to question a verb tense, a stray comma, or the shape of the narrative itself. This book is sharper and truer because of her attention.

In the end, this is the story of Mueller Associates—and of what becomes possible when institutional memory is valued and people care enough to preserve the record. I am grateful to those who made this history, to those who preserved it, and for the opportunity to pass it on.

Jason Dittrich
July 2026

SOURCES

Chapter One: The Early Years and the Environmental Vanguard

Washington National Cathedral

Anderson, David E. "Washington's National Cathedral is in Race with Time Involving People." *The Cincinnati Post*, June 25, 1977, p. 15.

Baze, Susan. "National Cathedral Completion Near." *The Star Press* (Muncie, Indiana), July 29, 1990, p. 33.

Bittner, R. Andrew. *Building Washington National Cathedral*. Mount Pleasant, South Carolina: Arcadia Publishing, 2015.

Cox, J.E. and Carlos R. (Chuck) Miró. "Keeping it Cool: National Cathedral." *ASHRAE Journal*, June 2001, pp. 12-13.

Nelson, W. Dale. "National Cathedral Nears Completion." *Fort Worth Star-Telegram*, September 28, 1990, p. 3.

———. "The Last Cathedral." *The Plain Dealer* (Cleveland, Ohio), August 11, 1990, p. 54.

———. "Three Quarters of a Century After It Was Begun, Washington National Cathedral Will Be Finished in September." *The Alliance Times Herald* (Alliance, Nebraska), July 27, 1990, p. 7.

The Hanford Sentinel (Hanford, California). "Washington National Cathedral About finished." September 2, 1990, p. 24.

Washington National Cathedral. "History." cathedral.org/discover/history/.

President Carter's Solar Energy Policy

Carter, Jimmy. "Solar Energy Remarks Announcing Administration Proposals." *The American Presidency Project*, June 20, 1979.

Wikipedia, "Solar power at the White House." Wikimedia Foundation. en.wikipedia.org/wiki/Solar_power_at_the_White_House

Environmental Movement and Earth Day

Eschner, Kat. "How an Oil Spill Inspired the First Earth Day." *Smithsonian Magazine*, April 19, 2019.

www.smithsonianmag.com/history/how-oil-spill-50-years-ago-inspired-first-earth-day-180972007/.

Rome, Adam. *The Genius of Earth Day: How a 1970 Teach-In Unexpectedly Made the First Green Generation*. New York: Hill & Wang, 2013.

Oil Embargo

Wikipedia. "1973 Oil Crisis." Wikimedia Foundation. en.wikipedia.org/wiki/1973_oil_crisis.

Mueller Associates Company Records

Mueller Associates archival materials; company newsletters; interview transcripts with staff and alumni; project documentation; and specifications.

"3 County Firms to Vie in Engineering Contest. *The Baltimore Sun*, April 13, 1980, p. 77.

"Consulting Engineers Open Washington Office.: *The Baltimore Sun*, January 10, 1982, p. 69.

"Crash Kills Driver." *The Evening Sun* (Baltimore), February 3, 1966, p. 50.

"Firm Announces Change of Name." *The Baltimore Sun*, February 9, 1975, p. 97.

"Mueller Associates, Inc., Consulting Engineers, Announced the Appointment of Richard P. Mueller to Chairman and the Election of Andrew J. Parker as President of the Baltimore-based Firm." *The Baltimore Sun*, March 7, 1982, p. 85.

"Mueller Associates Officer Named Engineer of Year." *The Baltimore Sun*, December 25, 1984, p. 35.

"Mueller Heads City Chapter of Heating Engineers." *The Baltimore Sun*, August 19, 1979, p. 87.

"Realty Notes.: *The Baltimore Sun*, March 15, 1981, p. 98.

"The 24th Fatality was Nelford P. Lloyd of Millersville, Whose Car Collided with the Bulldozer in Severna Park." *The Evening Sun* (Baltimore), February 3, 1966, p. 24.

Chapter Two: Advancing Long-Term Partnerships

Lyric Opera House

The Baltimore Sun. "New Old Opera House." December 15, 1982, p. 16.

———. "On With the Lyric." July 4, 1978, p. 12.

Brown, David. "The Lyric: Safer, but Is it Safe Enough?" *The Baltimore Sun*, January 16, 1983, p. B4.

Cera, Stephen. "'Final Plans' for Lyric: \$7.5-Million Overhaul." *The Baltimore Sun*, June 30, 1978, p. B4.

Dorsey, John. "Concert Hall & Opera House: Another Plan." *The Baltimore Sun*. June 4, 1978. Section D, pp. 1 and 8.

———. "Deciding the Fate of the Lyric." *The Baltimore Sun*. October 15, 1978, Section D, pp. 1 and 12.

———. "What Will They Do with the Lyric?" *The Baltimore Sun*. April 30, 1978, Section D, pp. 1 and 34.

———. "Why Do We Need Another Concert Hall?" *The Baltimore Sun*. March 19, 1978, Section D, pp. 1 and 8.

Duncan, Scott. "Lyric Plans Expansion for Bigger Productions." *The Evening Sun* (Baltimore). September 15, 1989, E1.

Gunts, Edward. "Addition to Lyric Opera House May Project Over Maryland Ave." *The Baltimore Sun*. December 23, 1990, p. 105.

———. "The Next Act: As the Lyric Reaches the Century Mark, Its Guardians Are Hoping There's Life in the Old Theater Yet." *The Baltimore Sun*. October 23, 1994, pp. 182, 185-192.

Smith, Tim. "Lyric Opera House to Carry Modell Name After \$3.5 Million Gift." *The Baltimore Sun*. September 3, 2010, p. A2.

———. "New Company Works to Bring Sound of Opera Back to Town." *The Baltimore Sun*. February 14, 2011, pp. A1 and 13.

Stanton, Phoebe. "A Critical Look at the Concert Hall Plans." *The Baltimore Sun*. April 3, 1977, Section D, p. 1.

Northrop Grumman Corporation

Encyclopedia.com. "Northrop Grumman Corporation."

Mueller Associates Company Records

Mueller Associates archival materials; company newsletters; interview transcripts with staff and alumni; project documentation; and specifications.

Chapter Three: The Technological Revolution Accelerates

Space Telescope Science Institute and Johns Hopkins University

Dieterle, Marcus. "NASA's Space Telescope Science Institute at Hopkins Celebrates 40th Anniversary." *Baltimore Fishbowl*, August 10, 2022.

Space Telescope Science Institute. "Our History."

———. "STScI Timeline."

———. "Who We Are."

Mueller Associates Company Records

Mueller Associates archival materials; company newsletters; interview transcripts with staff and alumni; project documentation; and specifications.

Chapter Four: A Decade of Transition and Renewal

Georgetown University

Curran, Robert Emmett. *A History of Georgetown University, Vol. 1: From Academy to University, 1789–1889*. Washington, D.C.: Georgetown University Press, 2010.

———. *A History of Georgetown University, Vol. 2: From Academy to Prominence in the Twentieth Century, 1889–1964*. Washington, D.C.: Georgetown University Press, 2010.

———. *A History of Georgetown University, Vol. 3: The Quest for Excellence, 1964–1989*. Washington, D.C.: Georgetown University Press, 2010.

O'Neill, Paul R., and Bennie L. Smith. *Georgetown University*. Charleston, South Carolina: Arcadia Publishing Campus History Series, 2013.

Winterthur Museum, Garden & Library

Cooper, Wendy A. *An American Vision: Henry Francis du Pont's Winterthur Museum*. London: Lund Humphries, 2002.

Lord, Ruth. *Henry F. du Pont and Winterthur: A Daughter's Portrait*. New Haven, Connecticut: Yale University Press, 1999.

Wikipedia. "Henry Francis du Pont." May 25, 2025.

———. "Winterthur Museum, Garden & Library." August 26, 2025.

Wilkie, Carter. "Collector on a Grand Scale: The Horticultural Visions of Henry Francis du Pont." *Arnold Arboretum, Harvard University*. March 31, 2025.

Walters Art Museum

Johnston, William R. *William and Henry Walters, the Reticent Collectors*. Baltimore: Johns Hopkins University Press, 1999.

Walters Art Museum. "About the Walters Art Museum."

Mueller Associates Company Records

Mueller Associates archival materials; company newsletters; interview transcripts with staff and alumni; project documentation; and specifications.

The Baltimore Sun. "EA Engineering Pays \$2.75 Million to Acquire Mueller Associates, Inc." March 9, 1988, p. 28.

———. "EA Engineering Science and Technology Inc." January 12, 1989, p. 60.

Frank, Peter H. "EA Engineering is Acquiring Mueller Firm." *The Baltimore Sun*. November 25, 1987, p. 19, p. 4C, Cols. 1 and 16.

Chapter Five: Entering the New Millennium

Wake Forest University School of Medicine

Wake Forest University School of Medicine. "History."

Kennedy Center for the Performing Arts

Hunting, Mary Anne. *Edward Durell Stone: Modernism's Populist Architect*. New York: W.W. Norton & Company, 2013.

Kennedy Center. "Creating the National Cultural Center."

———. "History."

———. "Kennedy Center for the Performing Arts."

Smithsonian Institution Archives. "Kennedy Center Opens."

Mueller Associates Company Records

Mueller Associates archival materials; company newsletters; interview transcripts with staff and alumni; project documentation; and specifications.

Rector, Kevin. "Gary E. Johnson, Retired Engineering Firm Partner, Dies of Coronavirus." *Capital Gazette*, May 8, 2020. <https://www.capitalgazette.com/2020/05/08/gary-e-johnson-retired-engineering-firm-partner-dies-of-coronavirus/>.

Chapter Six: Pioneering Digital Design

Thomas Jefferson and Monticello

Ayers Saint Gross. "Thomas Jefferson Visitor Center and Smith Education Center." www.ayerssaintgross.com/work/project/monticello-visitor-center/

Engineering News-Record. "Monticello Visitor and Smith History Center, Charlottesville, Va." December 1, 2009. www.enr.com/articles/18651-monticello-visitor-and-smith-history-center-charlottesville-va

Fisher, Thomas. "Welcome To Monticello." *Architect Magazine*. August 6, 2007. www.architectmagazine.com/design/buildings/welcome-to-monticello_o

Gordon-Reed, Annette. *The Hemingses of Monticello: An American Family*. New York: W.W. Norton & Company, 2009.

Howard, Hugh, and Roger Straus III. *Thomas Jefferson: Architect: The Built Legacy of Our Third President*. New York: Rizzoli, 2003.

Landscape Performance Series. "Thomas Jefferson Visitor Center and Smith Education Center at Monticello." Landscape Architecture Foundation, 2014. www.landscapeperformance.org/case-study-briefs/monticello-visitor-center

Stanton, Lucia. *"Those Who Labor for My Happiness": Slavery at Thomas Jefferson's Monticello*. Charlottesville, Virginia: University of Virginia Press, 2012.

Thomas Jefferson Foundation. "Foundation Goals and Programs." www.monticello.org/thomas-jefferson-foundation/thomas-jefferson-foundation-an-overview/

———. *Monticello: The Official Guide to Thomas Jefferson's World*. Washington, D.C.: National Geographic, 2012.

———. "Publications." www.monticello.org/research-education/for-scholars/publications/

Mueller Associates Company Records

Mueller Associates archival materials; company newsletters; interview transcripts with staff and alumni; project documentation; and specifications.

Chapter Seven: Four Presidents, One Enduring Vision

Mueller Associates Company Records

Mueller Associates archival materials; company newsletters; interview transcripts with staff and alumni; project documentation; and specifications.

Chapter Eight: Masters of Complexity

University of Baltimore John and Frances Angelos Law Center

ArchDaily. "John and Frances Angelos Law Center/Behnisch Architekten + ASG." August 1, 2013. www.archdaily.com/409062/john-and-frances-angelos-law-center-behnisch-architekten

Ayers Saint Gross. "John and Frances Angelos Law Center." www.ayerssaintgross.com/portfolio/ubl-john-and-frances-angelos-law-center

Behnisch Architekten. "The John and Frances Angelos Law Center." www.behnisch.com/work/projects/0521

Gunts, Edward. "A Bright New Face for UB Law School." *The Baltimore Sun*, Nov. 18, 2008, pp. A1 and 19.

Kilar, Steve. "UB Prepares to Open Green, Airy Law Center." *The Baltimore Sun*. April 9, 2013, pp. C1 and C3.

Shapiro, Gideon Fink. "John and Frances Angelos Law Center." *Architect Magazine*. April 28, 2014. www.architectmagazine.com/design/john-and-frances-angelos-law-center_o

National Academy of Sciences

Allion, Maggie. "Celebrating the Centennial of the National Academy of Sciences Building." *Issues in Science and Technology*, May 30, 2024. www.issues.org/centennial-nas-building-archives/

Brawer, Catherine Coleman. *Walls Speak: The Narrative Art of Hildreth Meiere*. Edited by Elaine Banks Stainton. Bonaventure, N.Y.: Franciscan Institute Publications, 2009.

Cochrane, Rexmond C. *The National Academy of Sciences: The First Hundred Years, 1863–1963*. Washington, D.C.: National Academy of Sciences, 1978.

Cultural Programs of the National Academy of Sciences. "100th Anniversary of the Art of the NAS Building."

———. "Guided Tour of the National Academy of Sciences Building." www.cpnas.org/event/guided-tour-of-the-national-academy-of-sciences-building-7/

DC Historic Sites. "National Academy of Sciences." www.historic-sites.dcpreservation.org/items/show/406

E Nebraska History. "Bertram Grosvenor Goodhue (1869–1924), Architect." [www.e-nebraskahistory.org/index.php?title=Bertram_Grosvenor_Goodhue_\(1869-1924\),_Architect](http://www.e-nebraskahistory.org/index.php?title=Bertram_Grosvenor_Goodhue_(1869-1924),_Architect)

Encyclopedia.com. "National Academy of Sciences." www.encyclopedia.com/science-and-technology/physics/science-general/national-academy-sciences

Kent, David J. "Lincoln Charters the National Academy of Sciences, 1863." *DavidJKent-Writer*, March 3, 2023. www.davidjkent-writer.com/2023/03/03/lincoln-charters-the-national-academy-of-sciences-1863/

National Academy of Sciences. "About the National Academy of Sciences." www.nasonline.org/about-the-nas/faq/

Oliver, Richard. *Bertram Grosvenor Goodhue*. Cambridge, Massachusetts: MIT Press, for the Architectural History Foundation, 1983.

Smithsonian Institution Archives. "National Academy of Sciences." www.siarchives.si.edu/history/featured-topics/henry/national-academy-of-sciences

Wikipedia. "Bertram Goodhue."

———. "National Academy of Sciences." en.wikipedia.org/wiki/National_Academy_of_Sciences

———. "National Academy of Sciences Building." en.wikipedia.org/wiki/National_Academy_of_Sciences_Building

Wyllie, Romy. *Bertram Goodhue: His Life and Residential Architecture*. New York: W.W. Norton & Company, 2007.

University of Maryland, Baltimore County, Performing Arts and Humanities Building

Alexander, Gregory J. "More Than Just Performing: Music Theatre Students Learn Diverse Skills." *The Baltimore Sun*. November 17, 2013, p. M4.

Architect Magazine. "Performing Arts and Humanities Building, UMBC." November 4, 2016. www.architectmagazine.com/project-gallery/performing-arts-and-humanities-building-umbc_o

The Baltimore Sun. "New UMBC Arts Center is Built for Show." September 3, 2014, p. T48.

Biemiller, Lawrence. "Performing Arts and Humanities Building, UMBC." *Architect Magazine*. November 4, 2016. www.architectmagazine.com/project-gallery/performing-arts-and-humanities-building-umbc_o/

Smith, Tim. "Built for Show." *The Baltimore Sun*. August 31, 2014, pp. E1 and E7.

UMBC. "Performing Arts and Humanities Building (PAHB)." www.pahb.umbc.edu/

William Rawn Associates Architects. "UMBC | Performing Arts and Humanities Building." Accessed on December 16, 2025. www.rawnarch.com/projects/umbc-performing-arts.html

Baltimore Museum of Art

Anderson, Louisa Garrett. *Elizabeth Garrett Anderson: 1836–1917*. Cambridge, U.K.: Cambridge University Press, 2016.

The Baltimore Sun, "New Art Museum." February 24, 1929.

———. "The BMA Turns 100." November 24, 2014, p. A14.

———. "Baltimore Museum of Art is Opened." October 15, 1992, p. 12.

———. "City Expected to Accept Museum This Week, After Conference." October 15, 1922, p. 18.

Bedford, Steven. *John Russell Pope: Architect of Empire*. New York: Rizzoli, 1998.

Boas, George. *The Cone Collection of Baltimore, Maryland: Catalogue of Paintings, Drawings, Sculpture of the Nineteenth and Twentieth Centuries*. Baltimore: Baltimore Museum of Art, 1934.

The Cecil Whig (Elkton, Maryland). "Baltimore Museum of Art Presents 'A Modern Influence: Henri Matisse, Etta Cone, and Baltimore.'" December 17, 2021.

Cone, Claribel and Etta Cone. *Cone Collection: A Handbook with a Catalogue of Paintings and Sculpture*. Baltimore: Baltimore Museum of Art, 1955.

Dohme, A.R.L. "The Baltimore Art Museum." *The Evening Sun* (Baltimore). November 7, 1913, p. 6.

Emmart, A.D. "The Museum Opens Doors at Last." *The Baltimore Sun*. April 21, 1929, pp. 1 and 94.

———. "Week in Art is Typical of Baltimore." *The Baltimore Sun*. April 28, 1929, pp. 88 and 94.

The Evening Sun (Baltimore). "Baltimore Museum of Art Taking Shape." December 10, 1914, p. 6.

Flam, Jack. *Matisse in the Cone Collection: The Poetics of Vision*. Baltimore: Baltimore Museum of Art, 2001.

Gilbert, Susan. "Matisse Center Opening Celebrates Artist's Bond with Baltimore Collector." *The Baltimore Sun*, November 21, 2021.

Harlow, Lisa. "Celebrating 100 Years of Art at BMA." *The Star Democrat*. November 21, 2014, p. 17.

Kahn, Eve M. "BMA Unveils Cone Collection Renovations." *The Baltimore Sun*, November 24, 2014.

———. "Matisse and the Cone sisters: A Modern Influence." *The Baltimore Sun*, November 15, 2014.

Levitov, Karen. *Collecting Matisse and Modern Masters: The Cone Sisters of Baltimore*. New Haven, Connecticut: Jewish Museum/ Yale University Press, 2011.

Maryland Center for History and Culture. "Baltimore Museum of Art." www.mdhistory.org/resources/baltimore-museum-of-art/

McCauley, Mary Carole. "Baltimore Museum of Art Pivots for a New Audience." *The Baltimore Sun*. November 15, 2014, pp. A1 and A14.

———. "BMA's Matisse Center 'A Coup for Baltimore.'" *The Baltimore Sun*. November 28, 2021, pp. A1 and A9.

———. "New Day at the BMA." *The Baltimore Sun*. November 21, 2014, pp. T16 and T17

Nasher Museum of Art at Duke University. "Collecting Matisse and Modern Masters: The Cone Sisters of Baltimore." archives.nasher.duke.edu/matisse/art.html

Rackemann, Francis. "Permanent Home Ready for Cone Collection." *The Evening Sun* (Baltimore). January 29, 1957, p. 17.

Richardson, Brenda. *Dr. Claribel and Miss Etta: The Cone Collection*. Baltimore: Baltimore Museum of Art, 1985.

Rodricks, Dan. "Matisse in Baltimore: A Bond for the Ages." *The Baltimore Sun*, November 28, 2021.

Rothkopf, Katy, and Leslie Cozzi, eds. *A Modern Influence: Henri Matisse, Etta Cone, and Baltimore*. Baltimore: Baltimore Museum of Art, 2021.

Mueller Associates Company Records

Mueller Associates archival materials; company newsletters; interview transcripts with staff and alumni; project documentation; and specifications.

Chapter Nine: Golden Anniversary and New Horizons

Salisbury University, Patricia R. Guerrieri Academic Commons

Ayers Saint Gross. "Salisbury University—Patricia R. Guerrieri Academic Commons." www.ayerssaintgross.com/work/project/salisbury-university-patricia-r-guerrieri-academic-commons/

Gilbane Building Company. "Salisbury University — Guerrieri Academic Commons." www.gilbaneco.com/projects/salisbury-university-guerrieri-academic-commons/

Nabb Research Center for Delmarva History and Culture. "About the Nabb Research Center." Salisbury University. www.salisbury.edu/nabb-research-center/about/

Salisbury University. "Patricia R. Guerrieri Academic Commons." www.salisbury.edu/academic-commons/

Sasaki. "Salisbury University Guerrieri Academic Commons." www.sasaki.com/projects/salisbury-university-guerrieri-academic-commons/

University of Maryland, College Park, Edward St. John Learning & Teaching Center

Ayers Saint Gross. "University of Maryland—Edward St. John Learning and Teaching Center." October 25, 2024. www.ayerssaintgross.com/work/project/university-of-maryland-edward-st-john-learning-and-teaching-center/

Edward St. John Foundation. "Edward St. John Learning & Teaching Center." www.esjfoundation.org/impact/edward-st-john-learning-and-teaching-center/

———. "Edward St. John Learning & Teaching Center at the University of Maryland Will Transform the Classroom Experience." May 11, 2017. www.esjfoundation.org/news-article/edward-st-john-learning-and-teaching-center-at-the-university-of-maryland-will-transform-the-classroom-experience/

Bowie State University Center for Natural Sciences, Mathematics, and Nursing

Bowie State University. "New Hub for Science Education and Research Opens at Bowie State University." 2017. bowiestate.edu/about/news/2017/new-hub-for-science-education-and-research-opens-at-bowie-state-university.php

Perkins&Will. "Bowie State University Center for Natural Sciences, Mathematics, and Nursing." January 18, 2023.

Prashad, D. and A. Chetia. "Chilled-Beam System." *ScienceDirect Topics*, 2014. www.sciencedirect.com/topics/engineering/chilled-beam-system

Trane Engineers Newsletter. "Understanding Chilled-Beam Systems." Vol. 38, No. 4. www.trane.com/content/dam/Trane/Commercial/global/products-systems/education-training/engineers-newsletters/airside-design/adm_apn034en_1209.pdf

Duke University Rubenstein Arts Center

Duke University. "Rubenstein Arts Center." arts.duke.edu/rubenstein-arts-center/

ENR Southeast. "Award of Merit: Rubenstein Arts Center." *Engineering News-Record*.

William Rawn Associates. "Duke University Rubenstein Arts Center." www.rawnarch.com/dukeruby

George Washington University Corcoran School of the Arts & Design

Bacon, Mardges. *Ernest Flagg: Beaux-Arts Architect and Urban Reformer*. Cambridge, Massachusetts: MIT Press, in cooperation with The Architectural History Foundation, 1986.

Education Snapshots. "George Washington University—The Corcoran School of the Arts & Design Renovation." February 11, 2025. educationsnapshots.com/projects/8066/the-george-washington-university-corcoran-school-of-the-arts-and-design-renovation/

George Washington University. "Corcoran Renovations Underway." *GW Today*. gwtoday.gwu.edu/corcoran-renovations-underway

———. "History." Corcoran School of the Arts & Design.

———. "(Re)dedicated to Art." Corcoran School of the Arts & Design. corcoran.gwu.edu/rededicated-art

George Washington University Libraries & Academic Innovation. "History of Corcoran Gallery of Art and Corcoran College of Art + Design." library.gwu.edu/history-corcoran-gallery-art-and-corcoran-college-art-design

Enoch Pratt Free Library

Architect Magazine. "Enoch Pratt Free Library." July 22, 2021. www.architectmagazine.com/project-gallery/enoch-pratt-free-library

Ayers Saint Gross. "Enoch Pratt Free Library—Library Renovation and Restoration." October 30, 2024. www.ayerssaintgross.com/work/project/enoch-pratt-library-renovation-and-restoration/

Baltimore Heritage. "The History and Award Winning Renovation of the Pratt Central Library (Virtual Talk)." baltimoreheritage.org/

event/the-history-and-award-winning-renovation-of-the-pratt-central-library-virtual-talk/

The Baltimore Sun. “A \$1,000,000 New Library.” October 23, 1932.

———. “\$2,000,000 Library for Baltimore.” February 12, 1933.

———. “Jackson Calls New Library Credit to City.” January 12, 1933.

———. “To Open in Three Weeks.” February 3, 1933.

Beyer Blinder Belle Stories. “Enoch Pratt Free Library.” www.beyerblinderbelle.com/stories/229_enoch_pratt_free_library

EverGreene. “Enoch Pratt Free Library Restoration.” October 1, 2024. evergreene.com/projects/enoch-pratt-free-library/

Explore Baltimore Heritage. “Central Library, Enoch Pratt Free Library—Enoch Pratt’s Library for ‘Rich and Poor.’” explore.baltimoreheritage.org/items/show/41

Foster, James W. “The Maryland Room in the New Library.” *The Baltimore Sun*. August 14, 1932, pp. 31, 57.

Pitts, Jonathan. “‘This is amazing!’: Thousands Pack Library After Renovation.” *The Baltimore Sun*. September 15, 2019.

Sears, Lori. “Enoch Pratt Books Quite a Celebration to Mark Expansion.” *The Baltimore Sun*. October 30, 2003.

Stiehm, Jamie. “Pratt to Show Off its Riches.” *The Baltimore Sun*. September 21, 2003.

Mueller Associates Company Records

Mueller Associates archival materials; company newsletters; interview transcripts with staff and alumni; project documentation; and specifications.

Chapter Ten: Meeting Modern Challenges

COVID-19 Pandemic

Data.gov. “MD COVID-19—Master Case Tracker.” catalog.data.gov/dataset/md-covid-19-master-case-tracker

Maryland Department of Health. “Maryland COVID-19 Data.” health.maryland.gov/covid/Pages/Maryland-COVID-19-Data.aspx

Pennington, Bill. “A Date for Postponed Preakness Remains Elusive as Third Saturday in May Nears.” *The Baltimore Sun*, May 2, 2020. www.baltimoresun.com/sports/horse-racing/bs-sp-preakness-postponement-no-announcement-20200502-orwemqdazrhdbdfiyd2bhdmk6q-story.html

Wikipedia. “Timeline of the COVID-19 Pandemic in January 2020.” December 2025. en.wikipedia.org/wiki/Timeline_of_the_COVID-19_pandemic_in_January_2020

Virginia Commonwealth University College of Health Professions

Plumbing Engineer. Swope, Chuck. “Designing Complex Plumbing Systems for a Health Sciences Building.” muellerassoc.com/wp-content/uploads/2023/05/Plumbing-Engineer-VCU-College-of-Health-Professions.pdf

Stantec (formerly Page). “Virginia Commonwealth University College of Health Professions.” www.stantec.com/en/projects/united-states-projects/v/virginia-commonwealth-university-college-health-professions-building

Virginia Commonwealth University. “College of Health Professions Building.” chp.vcu.edu/about/chp-building/

George Mason University Peterson Family Health Sciences Hall

George Mason University. “Peterson Family Health Sciences Hall.” chhs.gmu.edu/about/peterson-hall

University of Maryland Eastern Shore School of Pharmacy and Health Professions

Ayers Saint Gross. “School of Pharmacy and Health Professions, University of Maryland Eastern Shore.” www.ayerssaintgross.com/work/school-of-pharmacy-and-health-professions/

Morgan State University Calvin and Tina Tyler Hall

Architect Magazine. “Calvin and Tina Tyler Hall.” www.architect-magazine.com/project-gallery/calvin-and-tina-tyler-hall

GWWO Architects. “Calvin and Tina Tyler Hall, Morgan State University.” www.gwwo.com/work/calvin-tina-tyler-hall/

Morgan State University. “Calvin and Tina Tyler Hall.” www.morgan.edu/calvin-and-tina-tyler-hall

Teeple Architects. “Calvin and Tina Tyler Hall.” www.teeplearch.com/work/calvin-and-tina-tyler-hall/

Loyola University Maryland Fernandez Center

Catholic Review. Hooper, Maria. “Loyola University Maryland Opens \$40-million ‘New Front Door’ to Evergreen Campus.” September 30, 2021. catholicreview.org/loyola-university-maryland-opens-40-million-new-front-door-to-evergreen-campus/

Loyola University Maryland. “Loyola’s New Academic Building for Innovation and Collaborative Learning Receives LEED Gold Certification.” April 8, 2022. www.loyola.edu/news/2022/0408-leed-gold-certification.html

———. “Loyola University Maryland Opens a New Academic Building for Innovation and Collaborative Learning.” September 7, 2021. www.loyola.edu/news/2021/0907-fernandez-center-opening.html

Duke University Interprofessional Education and Care Building

Duke University School of Nursing. “Interprofessional Education and Care (IPEC) Building.” Accessed January 2026. nursing.duke.edu/about-us/ipec-building

Special Olympics Maryland

Hall, Sam. “How the Polar Bear Plunge Became a Chilly Chesapeake Bay Tradition.” *Baltimore Magazine*. January 23, 2024. www.baltimoremagazine.com/section/travel/polar-bear-plunge-maryland-tradition/

Wikipedia. “Polar Bear Plunge.” February 2025. en.wikipedia.org/wiki/Polar_bear_plunge

Industry Recognition

AIA Baltimore. “Mueller Associates Receives IAMFA’s Diplomat Award.” www.aiabaltimore.org/2023-03-20/mueller-associates-receives-iamfas-diplomat-award/

Mueller Associates Company Records

Mueller Associates archival materials; company newsletters; interview transcripts with staff and alumni; project documentation; and specifications.

Chapter Eleven: Leadership Transition and Future Vision

Capital One Hall

HGA. “HGA Completes Capital One Hall at the Heart of Capital One Center in Tysons, Virginia.” May 5, 2023. hga.com/hga-completes-capital-one-hall-at-the-heart-of-capital-one-center-in-tysons-va/

Tebo, Elizabeth. “Tysons Has a New Performing Arts Venue With a Sky Park.” *Arlington Magazine*. July 19, 2024. www.arlingtonmagazine.com/capital-one-hall-tysons-corner-opens-2021-fairfax/

Virginia.org. “Capital One Hall.” www.virginia.org/listing/capital-one-hall/24306/

National Museum of Women in the Arts

Architect Magazine. “National Museum of Women in the Arts to Undergo Significant Renovation.” May 17, 2021. www.architectmagazine.com/design/national-museum-of-women-in-the-arts-to-undergo-significant-renovation_o

Hampton, Olivia. “National Museum of Women in the Arts Reopening after \$70M renovation.” *NPR*. October 19, 2023. www.npr.org/2023/10/19/1207028398/a-museum-dedicated-to-women-in-the-arts-is-about-to-reopen-after-a-renovation

Holladay, Wilhelmina Cole, and Philip Kopper. *A Museum of Their Own: National Museum of Women in the Arts*. New York: Abbeville Press, 2008.

National Museum of Women in the Arts. "About | National Museum of Women in the Arts." October 5, 2023. nmwa.org/about/our-history

———. "Grand Reopening of National Museum of Women in the Arts on October 21, 2023, to Reveal Transformed Building, Immersive Inaugural Exhibitions and Remixed Collection." September 15, 2023. nmwa.org/press/grand-reopening-to-reveal-transformed-building/

Parker, Lonnael O'Neal. "Holladay Founded National Museum of Women in the Arts, Now She's Working on Its Legacy." *The Washington Post*. April 18, 2014. www.washingtonpost.com/lifestyle/style/holladay-founded-national-museum-of-women-in-the-arts-now-shes-working-on-its-legacy/2014/04/17/0b98f322-c4b5-11e3-bcec-b71ee10e9bc3_story.html

"PBS NewsHour. A Look Inside the National Museum of Women in the Arts After Its Major Renovation." November 23, 2023. www.pbs.org/newshour/show/a-look-inside-the-national-museum-of-women-in-the-arts-after-its-major-renovation

Mueller Associates Company Records

Mueller Associates archival materials; company newsletters; interview transcripts with staff and alumni; project documentation; and specifications.

Mann, Alex. "Richard Paul 'Dick' Mueller." *The Baltimore Sun*. 04 October 2021, p. A4.

Chapter Twelve: A Partnership to Preserve America's Treasures

Architects and Architecture

DeGregory, Lane. "An Aerospace Landmark Begins a Major Renovation." *Smithsonian Magazine*, March 19, 2019.

www.smithsonianmag.com/air-space-magazine/aerospace-landmark-begins-major-renovation-180971748/

Kohler, Sue A. *The Commission of Fine Arts: A Brief History 1910–1995*. Washington, D.C.: U.S. Commission of Fine Arts, 1996.

Leland M. Roth. *McKim, Mead & White, Architects*. New York: Harper & Row, 1983.

Longstreth, Richard (ed.). *The Mall in Washington, 1791–1991. 2nd ed.*, Washington, D.C.: National Gallery of Art, 2002.

Moore, Charles. *Daniel H. Burnham: Architect, Planner of Cities*. New York: Houghton Mifflin Company, 1921.

Scott, Pamela, and Antoinette J. Lee. *Buildings of the District of Columbia*. New York: Oxford University Press, 1993.

Wilson, Richard Guy, and Sidney K. Robinson. *The Architecture of Washington, D.C.* Washington, D.C.: AIA Press, 2006.

Smithsonian Museums

Kohler, Sue A., and Jeffrey R. Carson. "Creating a Model for the National Mall: The Design of the National Museum of Natural History." *Journal of the Society of Architectural Historians*, Vol. 63, No. 1, March 2004, pp. 52–73.

National Postal Museum. "Building a Landmark." postalmuseum.si.edu/building-a-landmark

———. "Building Architecture." postalmuseum.si.edu/exhibition/william-h-gross-stamp-gallery-supporting-areas-historic-lobby/building-architecture

Smithsonian Archives. "Architectural History of the National Air and Space Museum, 1972." siarchives.si.edu/collections/siris_sic_14442

———. "Architectural History of the National Museum of Natural History." Record Unit 45, siarchives.si.edu/collections/siris_sic_13668

———. "Architectural History of the National Postal Museum, 1911." siarchives.si.edu/collections/siris_sic_14446

———. “Architectural History of the Smithsonian National Zoological Park, 1889-1992.” siarchives.si.edu/collections/siris_sic_14434

———. “Concept Model of Exterior for the New National Air Museum.” Record Unit 07-010, Box 3, Folder 6, siarchives.si.edu/collections/siris_sic_14753

Mueller Associates Company Records

Mueller Associates archival materials; company newsletters; interview transcripts with staff and alumni; project documentation; and specifications.

Chapter Thirteen: Engineering the Future

Saint Mary’s College of Maryland Dodge Performing Arts Center

GUND Partnership. “St. Mary’s College of Maryland—Dodge Performing Arts Center and Learning Commons.” www.gund-partnership.com/projects/st_marys_college_dodge_performing_arts_center_and_learning_commons

GWWO Architects. “St. Mary’s College of Maryland Nancy R. & Norton T. Dodge Performing Arts Center & Learning Commons.” www.gwwoinc.com/projects/st-marys-college-of-maryland

Jones, Matt. “St. Mary’s College Opens New Performing Arts Building.” *Spaces4Learning*, September 29, 2022, spaces4learning.com/articles/2022/09/29/st-marys-performing-arts-building.aspx

St. Mary’s College of Maryland News. “Nancy R. & Norton T. Dodge Performing Arts Center & Learning Commons Named Maryland Public Buildings of the Year.” November 2023, inside. smcm.edu/news/2023/11/nancy-r-norton-t-dodge-performing-arts-center-learning-commons-named-maryland-public

Christopher Newport University, Torggler Fine Arts Center

Christopher Newport University. “Mary M. Torggler Fine Arts Center.”

Glavé & Holmes Architecture. “Mary M. Torggler Fine Arts Center.” www.glaveandholmes.com/projects/fine-arts-center

Radford University, Artis Center for Adaptive Innovation and Creativity

Hord Coplan Macht. “Artis Center for Adaptive Innovation and Creativity, Radford University.” www.hcm2.com/projects/radford-university-center-for-adaptive-innovation-and-creativity/

Radford Magazine. “A Building with ‘No Silos’: The Artis Center for Adaptive Innovation and Creativity.” Summer 2021, issuu.com/radforduniversity/docs/radfordmagazinesummer2021/s/43843918

Radford University News. “Radford University’s Artis Center for Adaptive Innovation and Creativity Earns National Recognition for Design Excellence.” November 14, 2025, www.radford.edu/news/2025/artis-center-award.html

Bowie State University, Martin Luther King, Jr. Communication Arts and Humanities Building

ArchDaily. “Bowie State University, Martin Luther King, Jr. Center/Perkins&Will.” March 22, 2025, www.archdaily.com/1028158/bowie-state-university-martin-luther-king-jr-center-perkins-and-will

Kennedy, Mike. “Bowie State University Opens \$166 Million Martin Luther King Jr. Center.” *American School & University*. www.asumag.com/planning-design/new-construction/article/55136343/bowie-state-university-opens-166-million-martin-luther-king-jr-center

Parlade Jr, Percival. “New MLK Jr. Building Gets Ready To Open Its Doors.” *The Spectrum* (Bowie State University). bowiestate.edu/academics/colleges/college-of-arts-and-sciences/departments/communications/student-organizations-and-publications/the-spectrum/2024/new-mlk-jr-building-gets-ready-to-open-its-doors.php

Perkins&Will. "Bowie State University's Martin Luther King, Jr. Center Empowers Voices of Change." January 7, 2025, perkinswill.com/news/bowie-state-universitys-martin-luther-king-jr-center-empowers-voices-of-change/

Mueller Associates Company Records

Mueller Associates archival materials; company newsletters; interview transcripts with staff and alumni; project documentation; and specifications.

Chapter Fourteen: Beyond the Horizon

Towson University College of Health Professions

Bradshaw, Megan. "Building the Future of Health Care." *Towson University News*. February 5, 2025. www.towson.edu/news/articles/2024/building-future-health-care.html

Kennedy, Mike. "Towson University Opens Health Professions Building." *American School & University*, September 17, 2024. www.asumag.com/planning-design/new-construction/article/55140348/towson-university-opens-health-professions-building

George Mason University Life Sciences and Engineering Building

Reuscher, Lauren. "George Mason's New Life Sciences and Engineering Building is Stocked with Potential Energy for Students and the Region." *George Mason University*. www.gmu.edu/news/2025-03/george-masons-new-life-sciences-and-engineering-building-stocked-potential-energy

Tradeline, Inc. "George Mason Opens Life Sciences and Engineering Building." www.tradelineinc.com/news/2025-4/george-mason-opens-life-sciences-and-engineering-building

George Mason University's Fuse at Mason Square

George Mason University News. "George Mason Hosts Grand Celebration of Fuse at Mason Square."

September 25, 2025. www.gmu.edu/news/2025-09/george-mason-hosts-grand-celebration-fuse-mason-square
———. "Fuse at Mason Square Powers Research and Innovation Through Collaboration." September 29, 2025. www.gmu.edu/news/2025-09/fuse-mason-square-powers-research-and-innovation-through-collaboration
———. "Fuse at Mason Square Recognized for Environmental Impact and Sustainable Design." November 5, 2025. www.gmu.edu/news/2025-11/fuse-mason-square-recognized-environmental-impact-and-sustainable-design

Northern Virginia Science Center (NoVaSci)

HGA. "Northern Virginia Science Center." hga.com/projects/northern-virginia-science-center/

Northern Virginia Science Center. "Project Details." www.novasci.org/project-details

Smithsonian Institution Steven F. Udvar-Hazy Center Expansion

Smithsonian National Air and Space Museum. "National Air and Space Museum Expands Its Steven F. Udvar-Hazy Center." September 9, 2025. airandspace.si.edu/newsroom/press-releases/national-air-and-space-museum-expands-its-steven-f-udvar-hazy-center

Virginia Tech Mitchell Hall

Virginia Tech Facilities. "Mitchell Hall (Randolph Hall Replacement)." www.facilities.vt.edu/design-construction/capital-construction/campus-construction-projects/replace-randolphhall.html

University of North Carolina Chapel Hill Carrington School of Nursing

Lebo, Anne. "UNC's Carrington Hall Renewal: Linking Design, Technology, and the Human Connection." www.littleonline.com/insights/uncs-carrington-hall-renewal-linking-design-technology-and-the-human-connection/

Ayers Saint Gross. "Carrington Hall Renewal." ayerssaintgross.com/work/project/carrington-school-of-nursing/

Towson University Smith Hall

Baltimore Fishbowl. "Towson University Is Turning Its Front Yard Into an HVAC System." baltimorefishbowl.com/stories/towson-university-is-turning-its-front-yard-into-a-hvac-system/

Towson University Facilities. "Smith Hall Renovation." www.towson.edu/facilities/construction/smith-hall-renovation.html

Towson University Newsroom. "TU in 2027: Get a glimpse of Smith Hall." www.towson.edu/news/articles/2024/smith-renderings.html

Mueller Associates Company Records

Mueller Associates archival materials; company newsletters; interview transcripts with staff and alumni; project documentation; and specifications.

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Mueller Associates Company Records

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Washington National Cathedral, c. 1970s, Mueller Associates

National Air and Space Museum, photograph by Brad Feinknopf

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Help wanted ad, *The Baltimore Sun*, April 14, 1968

Gene Nerf and Richard Mueller, c. 1970s, Mueller Associates

Washington National Cathedral architectural rendering, c. 1970s, Mueller Associates

Jimmy Carter's solar panel dedication ceremony, Jimmy Carter Presidential Library and Museum/NARA

Mueller Associates Inc. newsletter, Fall 1981, Mueller Associates

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Lyric Opera House, c. 1970s, Mueller Associates

Lyric Opera House 2011 stagehouse expansion, Mueller Associates

Northrop Grumman, photograph courtesy of Northrop Grumman

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Mueller Associates headquarters, c. 1980s, Mueller Associates

Paul Czajkowski, c. early 1980s, photograph courtesy of Paul Czajkowski; photo restoration by Craig Rhinehart

Mueller Associates Inc. newsletter, Fall 1983, Mueller Associates
"CEs Monitor Underground Storage Tank Regulations," *American Consulting Engineer*, Fall 1991

Johns Hopkins University Space Telescope Institute, Mueller Associates, 1986

National Museum of Women in the Arts, Mueller Associates, 1987

Mueller Associates Inc. newsletter, Fall 1986, Mueller Associates

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EA-Mueller headquarters, c. 1990, Mueller Associates

Mueller Associates II leadership, c. 1992, Mueller Associates

View of Georgetown University from across the Potomac River, Creative Commons license

Georgetown University central utility plant renovations, 1998–2018, Mueller Associates

Georgetown University, Lauinger Library, Booth Family Center for Special Collections, photograph by Nichols Donner

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Winterthur Museum, c. mid-1990s, Mueller Associates

Gene Nerf at Winterthur Museum, c. mid-1990s, Mueller Associates

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Gene Nerf at his desk, c. early 1990s, Mueller Associates

Exterior view of the John F. Kennedy Center for the Performing Arts, Creative Commons license

Kennedy Center Eisenhower Theater, photograph by Ron Blunt

Kennedy Center Terrace Theater, photograph by Ron Blunt

Momentum newsletter, Winter 2006, Mueller Associates

Mueller Associates II leadership, c. 1992, Mueller Associates

Chapter Six: Pioneering Digital Design

Bennet, Allegra, "Efficiency: Energy Costs Claim Hefty Share of Profits," *The Baltimore Sun*, Sept. 9, 2026, Page S2

Courtyard of the Thomas Jefferson Visitor Center, Creative Commons license

Thomas Jefferson Visitor Center, photographs by Alan Karchmer

Revit model of the University of Delaware Admissions Center, Mueller Associates

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"Four Presidents: Celebrating Our Leadership" mailer, 2006, Mueller Associates

Gene Nerf, courtesy of Gene Nerf

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Rehearsal studio of the University of Maryland, Baltimore County Performing Arts and Humanities Building, photograph by Robert Benson

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"The New Art Museum," *The Baltimore Sun*, April 21, 1929

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Mann, Alex, "Richard Paul 'Dick' Mueller," *The Baltimore Sun*, Oct. 4, 2021

Todd Garing at the South Edgewood Street office, c. 2000s, Mueller Associates

"To Our Clients and Colleagues," *Momentum* newsletter, Spring 2022, Mueller Associates

Capital One Hall, photographs by Alan Karchmer

Interior galleries and the Great Hall of the National Museum of Women in the Arts, photographs by Jennifer Hughes/JBSA

The National Museum of Women in the Arts project team, photograph by Kevin Allen, courtesy of the National Museum of Women in the Arts

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About the Author

Jason Dittrich is Director of Business Development and Marketing at Mueller Associates, where he has helped lead the firm's communications, client engagement, and storytelling efforts since 2019. A Baltimore native, he holds two master's degrees from Johns Hopkins University, with an academic background spanning English Language and Literature, Liberal Arts, American History, Marketing, and Business Administration. He has written about architecture, engineering, museums, cultural institutions, and the built environment.

For Mueller's 60th anniversary, Jason led the development of this commemorative history, drawing upon interviews, archival materials, project records, and the reflections of current and former employees, to tell the story of a firm whose work has helped shape many of the most significant civic, cultural, and educational spaces in the Baltimore-Washington, D.C. region and beyond.

