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"Public Works Should Educate Public Taste": John A. Roebling's Design of the Cincinnati-Covington Bridge

This paper will explore the evolution of John A. Roebling's design of the Cincinnati-Covington Bridge, now known as the John A. Roebling Bridge, and its influence on his design of the Brooklyn Bridge.

When John A. Roebling submitted his first proposal to Cincinnati and Covington business leaders in September 1846, for a wire cable suspension bridge across the Ohio River, he wrote: "This bridge, when constructed, will possess great claims as a national monument. As a splendid work of art and as a remarkable specimen of modern engineering, it will stand unrivaled upon this continent."

This was a big leap forward for Roebling, as he had only built two suspension bridges in Pittsburgh, each with multiple spans of 182 feet (55 m) or less on the piers of former bridges. After completing the second of these in February 1846, he submitted patent applications for his wire spinning and cable anchoring methods that became standard practice for suspension bridges.

Roebling's Cincinnati-Covington Bridge proposal, which his son Washington A. Roebling later characterized as a "noble plan," specified a 200-foot (61-m) tall central tower with a Gothic arch in the middle of the river and 800-foot (244-m) side spans with 60-foot (18-m) towers on each bank.

Ten years later, having completed his 821-foot (250-m) span Niagara Falls Bridge, and after a tower in the middle of the Ohio River had been ruled out, Roebling designed a bridge with two towers, an 1,057-foot (322-m) central span, and 281-foot (86-m) side spans. For the towers, he experimented with Egyptian, Gothic, and Romanesque designs.

After the Civil War, Washington joined his father on the bridge and struggled to complete the long cables, as he later noted, "To break in a lot of new hands at cable making is always an ugly job, particularly in such a windy situation. Few men have the nerve to do it. It was expected that six months would suffice to make cables, but it took nine owing to the winds. Every day meant hard work on the bridge."

John designed all the bridge details, from railings to masonry, with great care for their appearance. As he wrote in his report to the Cincinnati-Covington Bridge trustees in April 1867, "Where strength is to be combined with lightness and elegance, nature never wastes cumbrous masses. Architects of the middle ages fully illustrated this fact by their beautiful buttresses and flying arches, combinations of great strength and stability, executed with the least amount of material. A public work which forms a conspicuous landmark across the great river should also serve as a model of appropriate architectural proportions. Public works should educate public taste."

When Roebling designed details of the Brooklyn Bridge that summer, he drew extensively upon his experience with the Cincinnati-Covington Bridge. In his September 1867 report to the Brooklyn Bridge trustees, he wrote, "The great towers will serve as landmarks to the adjoining cities, and they will be entitled to be ranked as national landmarks."

Clifford W. Zink is an historian and historic preservation consultant based in Princeton, New Jersey, and the recipient of the 2011 John A. Roebling Award from SIA's Roebling Chapter for an outstanding contribution to documenting or preserving the industrial heritage of the greater New York-New Jersey area. He has an M.S. in Historic Preservation from Columbia University's Graduate School of Architecture, Planning, and Preservation, and he specializes in architectural, industrial, engineering, and landscape history. His books include *The Roebling Legacy* (www.roeblinglegacy.com); *The Hackensack Water Works*; *The Monmouth County Park System: The First Fifty Years*; *Mercer Magic: The Mercer Automobile Company, Founded 1909*; and *Spanning the Industrial Age: The John A. Roebling's Sons Company, Trenton, New Jersey.* Mr. Zink has served as consulting curator at the Roebling Museum, and wrote and directed its orientation film, *Roebling Stories.*

Cincinnati's Abandoned Subway

Cincinnati is the site of the country's largest never-completed rapid transit system. Approximately ten miles (16 km) of the sixteen-mile (26-km) "Rapid Transit Loop" was built between 1920 and 1927, including a two-mile (3-km) cut-and-cover subway tunnel built in place of the disused Miami and Erie Canal. This tunnel is the most significant vestige of the project, as approximately eight miles (13 km) of the line's surface construction was bulldozed for construction of Interstate 75 and the Norwood Lateral Expressway.

Although the Rapid Transit Loop's original suburban route was claimed by highways, use of the old subway as an approach to downtown Cincinnati has been a part of various postwar transit proposals. In 2010-2011, the Rapid Transit Tubes Joint Replacement Project, funded by the City of Cincinnati and administered by its Department of Transportation and Engineering, performed extensive repair work on the subway tunnel. This work was the most extensive since the subway was constructed ninety years ago, and ensures its utility for decades to come.

Conversion of the subway for use by modern low-platform light rail trains will require reconstruction of its original stations, which were built to the same specifications as Boston's high platform Cambridge-Dorchester Subway (today's Red Line). This does not present a significant engineering challenge, as the tunnel's three stations are, like the tunnel itself, located immediately below street level and do not conflict with adjacent structures. The much greater challenge remains the task of convincing Cincinnatians to vote for a regional transit network that would make use of the old subway. Such ballot issues have failed in 1979, 1980, and 2002.

Jake Mecklenborg is the author of *Cincinnati's Incomplete Subway: The Complete History,* published in 2010 by The History Press. He is also a regular contributor to UrbanCincy.com and has been active in recent efforts to build Cincinnati's modern streetcar. He earned degrees in photography from the University of Tennessee and from Ohio University, and has taught photography at Ohio University and at Antonelli College in Cincinnati.

Historic Cincinnati Union Terminal – Restoration and Renovation Master Plan

Cincinnati Museum Center, a Continuing Experiment – The 25th Year

The Cincinnati Union Terminal is arguably one of the most significant national historic landmarks in America today. A magnificent railroad station and an exquisite example of Art Deco architecture, it now houses the Cincinnati Museum Center, a diverse institution and a popular destination that unites the Cincinnati Historical Society, the Cincinnati Children's Museum, the Museum of Natural History and Science, and the Robert D. Lindner Family OMNIMAX Theater under one roof. The Terminal was designed by the noted New York firm of Fellheimer & Wagner, experts in railroad facilities with a national architectural practice, in collaboration with Paul Phillipe Cret, the noted Philadelphia architect, as design consultant.

The project was an enormous undertaking by any standards, from how the land was assembled to how the site was re-engineered to accommodate the large yard, the support rail facilities, and a major postal distribution center. A series of viaducts and roadway improvements connect this "city within the city" to the urban transportation infrastructure of Cincinnati, making it an anchor of Cincinnati's West End. The Union Terminal building, when completed in 1933, was one of the earliest forms of intermodal transportation hubs, allowing for the railroads, private automobiles, taxicabs, buses, and a planned light rail system to converge within the Terminal in a masterful combination of traffic engineering, urban design, planning, and architecture.

In November 1990, after a decade of non-use, the Union Terminal opened its doors as the Cincinnati Museum Center, saving the building and providing a new home to two of the City's existing museum institutions, creating a new destination and a "Gateway to Knowledge."

The 1990 conversion of the building into a museum facility was indeed an experiment. The converted facility contained nearly a half million gross square feet (46,000 m^2) of space, much of which was designed for railroad station functions (vehicle ramps, garages, and baggage handling areas) and was never intended to be used as "finished" space, let alone for museum galleries.

In 2005, a new tax levy request provided the opportunity for the Cincinnati Museum Center to re-examine the needs of the building, the site, and its mission as a major museum facility in the region and the nation. It is in the context of this initiative that a Master Plan for the Cincinnati Museum Center Restoration and Renovation Project was prepared to critically examine the "bones" of the building as they align with planned programmed use in the growth of the Museums. CMC developed a technical process and vision for the future of the building and finally truly regarding Cincinnati Union Terminal as arguably the Museum's most important artifact.

This presentation will provide a brief contextual overview of the history of the Union Terminal, and examine the various changes made in recent years. We will outline the process used in establishing a technical guideline for future renovation and restoration efforts of a National Historic Landmark and adaptive reuse project of this scale. We will also examine the technical investigative approach, findings and lessons learned while completing the Master Plan and the recent "First Project." Topics will include the condition of the building and its site today brought on by deficiencies in the original design and construction, a long period of deferred maintenance, the limitations of the 1990 adaptive reuse project, and the next steps CMC is following to "Save the Terminal."

Arthur A. Hupp, AIA, LEED AP is a Principal at Cincinnati-based glaserworks Architecture + Urban Design. Art has worked as Project Manager/Project Designer on numerous complex historic preservation projects in the region including Cincinnati's Union Terminal, Historic Findlay Market, Cincinnati Music Hall, and St. Xavier Church. His efforts at CMC began with the adaptive reuse project begun in 1989 to leading the glaserworks team in implementing the Museum Center Restoration and Renovation Master Plan and its "First Project" completed earlier this year. Art has Bachelor of Science and Master of Architecture degrees from Ohio State University and leads the Cultural and Higher Education Studio at glaserworks.

A Public and Private Mining Landscape: Gold Mining in the Tarcoola Range, South Australia

American mining landscapes were historically shaped by the hands of commercial interests. Australia, too, tended towards this same pattern but the Tarcoola Range 375 miles (600 km) northwest of Adelaide, is a contrasting example.

Private and public interests rushed north to make their mark on Tarcoola in the early twentieth century. The Tarcoola Blocks Company and the South Australian government invested in two very different visions: one based on efficiency, productivity, and profit, and the other on stability, permanency, and prosperity. Both immediately invested in a crushing battery and cyanide plant, but the similarities stop there.

The Tarcoola Blocks Company focused on its own needs, with decisions based on costs and immediate requirements. Thus, it bought water off a local supplier at high rates rather than develop its own permanent source. The government concentrated on the needs of those across the range and the theoretical masses anticipated to follow. Thus, it provided subsidized water, health care, and ore reduction facilities for all. Its plans for the Tarcoola Township briefly took hold before melting away; a mirage of the dreams of that generation.

Today, waste rock piles, pits, and battered buildings tell the story of what happened at South Australia's largest reef goldfield, set within a wider narrative of growth and decline of government led settlement of the state's harsh interior.

Dr. Cameron Hartnell practiced as a heritage consultant in Sydney, Australia, before working with ICOMOS (International Council on Monuments and Sites) offices in Europe and the United States. Hartnell earned his doctorate in Industrial Heritage and Archaeology at Michigan Technological University in 2009, focusing on American coal mining in high-Arctic Spitsbergen. He now lives in South Australia and works for the Department of Environment and Natural Resources conducting heritage assessments, heritage policy, and providing archaeological permit advice for the state government.

Gypsum Down Under: Inneston, South Australia 1913-1930

Inneston, South Australia, is located at the tip of the Yorke Peninsula. During the Pleistocene, sea water flowed into low-lying areas blocked from the ocean by a small shelf. Those pools evaporated slowly, laminating layers of gypsum together to form deposits of four feet (1.2 m) on average of rock gypsum.

There are a variety of uses for gypsum, including agriculture and the building industry. In the nineteenth and early twentieth century, the United States was both the largest consumer and producer of gypsum. With the introduction of American gypsum wallboard in 1888, the global demand and usefulness of gypsum became apparent. In Victoria and particularly Melbourne, the building industry's demand for gypsum was insatiable in the 1880s, followed by a sharp decline before the turn of the century. Before World War I, another building boom occurred and Inneston played a vital part in that story.

Inneston was in a prime location at the water's edge with mineral deposits very close to the surface. Men removed rock gypsum by hand with horses transporting the gypsum in carts to the shore. Between 1913 and 1930, around a fifth of the gypsum excavated in Australia came from Inneston. A plaster factory built in 1915 converted gypsum into 300 tons (270,000 kg) of plaster weekly. Within the context of the South Australian gypsum industry, which provided three quarters of the Australian market, this presentation will focus on the Peninsula Plaster Company and its typical mining town of Inneston.

Inneston had an array of housing options for its workforce: single men's quarters, worker cottages, and large estates for those in charge. The community was well-rounded with a store, combined school and hall, and several company-supplemented sports facilities. Surprisingly unlike many mining communities, Inneston lacked a church. Although the company was consolidated in 1930 and mining of Inneston Lake ceased, members of the community remained until 1969, when it became a national park.

Dr. Elizabeth Hartnell is the curator at the Unley Museum in South Australia. Her graduate career focused on the West Point Foundry archaeological project for eight years. In her dissertation, Elizabeth compared ceramic assemblages from that foundry with other contemporary industrial communities in the United States. Her current interests include mining history and communities in Australia.

The Industrial Archaeology of the Abandoned Mineral Lands Project in Alaska

Established in 1983, the goals of the National Park Service's Abandoned Mineral Lands (AML) Project are to inventory all abandoned mineral exploration and extraction sites located on NPS land, to preserve and interpret the archaeology and historical narrative of the sites, and to eliminate or mitigate hazards and adverse environmental effects posed by the current condition of the sites. The program also serves as a means through which the NPS may fulfill the needs of the National Historic Preservation Act (NHPA) and National Environmental Preservation act (NEPA) with respect to abandoned mineral lands on park property. Since the program's inception, AML teams in the National Park Service's Alaska Region have inventoried hundreds of sites in eleven national parks, performed mine closures to protect both cultural resources and park visitors, and nominated historically significant sites to the National Register of Historic Places. All AML projects are carried out by multidisciplinary teams composed of geologists, archaeologists, and historians, along with the bush pilots and support staff that are a critical part of any fieldwork in Alaska's rugged and challenging environment.

The very remoteness and inaccessibility of many abandoned mineral lands can serve as powerful preservation agents. Many of the sites visited by the AML team have seen little disturbance since they were last active and are exceptionally well preserved. Between 2010 and 2011, the Alaska Region AML team inventoried twenty-two sites in Wrangell-St. Elias National Park and Preserve and Kenai Fjords National Park and performed adit closures on sixteen sites. However, the work goes beyond simple compliance with such laws as the NHPA and NEPA; upon finishing their fieldwork, NPS archaeologists and historians have produced National Register nominations and publications for park visitors. This paper gives an overview of recent AML projects at the Rossness and Larson Mine in Kenai Fjords National Park and Radovan Gulch in Wrangell-St. Elias National Park and Preserve, and discusses the ways in which the AML program has helped advance our understanding of and ability to preserve historic mining sites in Alaska.

Dan Trepal received his M.S. degree in Industrial Archaeology from Michigan Technological University in 2008, with a thesis focusing on the iron casting technology of the West Point Foundry. A Cleveland native, he currently works as an archaeologist for the National Park Service and is based out of the Alaska Regional Office in Anchorage, Alaska.

Milling about the Keweenaw: Providing a Temporal and Physical Context for Early Copper Country Milling Practice

The 150-year lifespan of Michigan's native copper mining industry produced approximately 11 billion pounds (5 billion kg) of copper. In the earliest years of the industry (the 1840s and 1850s), mining concentrated on fissure veins containing immense deposits of solid, or mass, copper. However, mass copper only accounted for a fraction of those 11 billion pounds. The vast majority of this production came from milling and concentration technologies developed after the industry shifted its focus from fissure deposits of mass copper to finely disseminated ore bodies such as the Calumet conglomerate lode. This shift began during the Civil War period, when copper prices saw their greatest rise, and concluded by the close of the 1880s, when the great fissure mines of the mid-nineteenth century finally pinched out.

This shift in industrial practice created an attention to detail, both technologically and economically, that allowed for a document-rich trove of archival information for those interested in the history of Michigan's "Copper Country" milling practice, post-1880. Coincidentally, it also exposed a lack of archival information regarding the previous thirty-plus years of milling history, leaving researchers with little to work with other than the numerous and poorly documented physical remains that dot the Copper Country. From what little documentation is available, it is evident that early milling practice was heavily dependent on British, and especially Cornish, technology and expertise.

Over the last year, a survey of early copper mills was undertaken in order to shed light on what archaeological resources are available to bring this early milling history to light. At the time of writing, over fifty mill sites dating from the mid-nineteenth century have been identified and mapped, with another dozen or so still needing locating. With such a large sample size temporal and typological patterns regarding footprint, power generation, milling and concentration technologies, and the mill's physical relationship to water can be made. Out of these patterns a more robust understanding of early Copper Country milling practice and possible Cornish influence on it will be possible.

This presentation will briefly discuss the history of early Copper Country milling and provide broad overviews of patterns either hypothesized or confirmed by the physical remains encountered during the mill location survey. Case studies will be presented in order to further illustrate these patterns, and several maps will demonstrate the importance of environmental factors, primarily water, that influenced the siting of these mills.

Sean M. Gohman is currently entering his fifth year in the Industrial Archaeology program at Michigan Technological University. His first two years in the program were spent working towards a Master's degree, which he completed in the summer of 2010. Currently, Sean is in his third year as lead investigator in the Cliff Mine Archaeology Project, Michigan Tech's archaeological field school program. His Ph.D. research builds off this project and is concerned with the history of copper milling technology in Michigan's Copper Country, specifically the early years of technological practice in the years 1845-1885. Currently, Sean is in his third year as lead investigator in the Cliff Mine Archaeology Project.

Sean is a native of Minnesota, but has called the Upper Peninsula of Michigan home for nearly eight years. His interest in the local history and community led him toward an active involvement in local industrial heritage issues, and his long tenure as a student at Michigan Tech drives him to take on a mentoring role for incoming students and enthusiasts of industrial archaeology at MTU. This will be Sean's third SIA conference and he finds the yearly trip to be great way to stay industrious, in terms of both research and productivity.

Dirty Ores and Ingenious Mechanics: The Origins of American Ore Washing Machinery

Iron ore is abundant in the eastern United States, but a band of it on the eastern shoulder of the Appalachian Front is a brown hematite (limonite) found most often embedded in clay and sand beds. This ore, found from Alabama to Pennsylvania, was first exploited in the central Pennsylvania ore fields as early as the 1790s. Early ore was picked by hand, and there were sufficient quantities of lump ore easily retrieved from the clay that pig iron from these "Juniata Iron" ores became known throughout the new Republic. By the mid-nineteenth century, however, the easily-obtained lump ore became more scarce, and as the fame of the ore and demand for the iron grew, more and more marginal ore beds were opened—marginal only in the sense that the high-quality ore came in smaller nuggets embedded in clay and therefore was harder to extract. This "wash ore" drove Pennsylvanian production to new heights until the 1870s, when Lake Superior ore began to drive Appalachian mining out of business … though not without one last and major gasp from 1880 to 1910.

Thus it was that in 1837, a Centre County, Pennsylvania, millwright, Frederick Fredly, patented the first American ore washer and initiated a century of development of this important extractive technology. Ore washers differ from buddles in that most washers involve rotating machinery to stir and move the ore through a vat of water (buddles are traditionally inclined troughs without mechanical agitation to wash away gangue), which is then flushed constantly to float off the clay and sand while the iron ore is mechanically moved to the collection end. Although Fredly received U.S. Patent No. 171 for his invention, his mining and smelting operation was an abject failure and he died shortly after receiving the patent. Five years later, another ironmaster in nearby Bellefonte, Abraham Valentine, developed an ore washer of a separate design, known as a "log washer," which was subsequently patented as the "double log washer" by Samuel Thomas of Allentown in 1856.

This talk will detail Fredly and the early history of American ore washing and discuss the mining challenges and expansion of the industry in Centre County, and then briefly describe the peak of the industry in the region in the 1890s, including an overview of the Andrew Carnegie operation at Scotia, Pennsylvania, and some recent IA fieldwork on the Tow Hill mining site in the southwestern corner of the county.

Steven A. Walton is an assistant professor of Science, Technology, and Society at Pennsylvania State University, and will in Fall 2012 be joining the Michigan Technological University Department of Social Science as an assistant professor of European history and the history of science and technology. His work spans the history of technology and industry from late Roman to mid-nineteenth century topics, in both Europe and North America. Of particular interest to him are military technologies such as artillery, torpedoes, and fortifications, and industrial technology and machinery of watermills, windmills, and iron production (furnaces, casting, rolling mills, and so on). The work being presented here comes out work with the Centre County [Pennsylvania] Historical Society on the history of iron mining in the county, and in particular the work at documenting and interpreting the Carnegie-built Scotia mines.

Preliminary Findings of a Chepachet Mill Site, Glocester, Rhode Island

Erin Timms and Suzanne Cherau of PAL recently completed Phase II archaeological investigations for the Chepachet Village Middle Privilege Archaeological Site (RI-2476) in Glocester, Rhode Island. The middle textile mill privilege was first used in the late eighteenth century to serve a tannery and a blacksmith shop, and was expanded in the early nineteenth century for a gristmill, distillery, sawmill, and cotton mill. These smaller mills were eventually replaced with large brick and stone factory operating under the name F. R. White Co. The factory's operations expanded to include worsteds production and several large mill additions, employing over 400 workers, some of whom lived in worker housing near the factory site. The complex was the largest industry in Chepachet until it was destroyed by fire in 1897.

The archaeological investigations were focused on the worker housing component of the middle textile mill privilege. This area contained several large mid-to-late-nineteenth-century tenements as well as the documented location of an earlier "Stone House" built by early mill occupants. The excavations within and around the Stone House foundation determined that it included at least two additions as well as a stone-lined well in a small yard area adjacent to the house. The main structure foundation appears to have been square, measuring about 30 by 30 feet (9 by 9 m), and constructed exclusively of drylaid stone with some limited mortar pointing. A center chimney base, measuring roughly 7 by 15 feet (2.1 by 4.6 m), was present in the main structure foundation. It was constructed of rough fieldstones and mortar. A low cellar may have been present in the southern half of the house, while the northern half may only have had a small crawlspace underneath the main floor. The stone-lined well measured roughly 5 feet (1.5 m) in external diameter, and appears to have been surrounded by a small semi-circular stone retaining wall that could have supported a fence to delineate this side yard area from the adjacent mill yard.

The subsurface testing also resulted in the recovery of over 120,000 post-contact cultural materials from overburden and slopewash, fill deposits, A and B soil horizons, and redeposited or disturbed A/B/C soil horizons. Preliminary review of the artifacts suggests a date range largely in the second half of the nineteenth century for manufacture of diagnostic materials, although a distinct late eighteenth or early nineteenth-century ceramic assemblage is also present. Artifact classes include a wide range of ceramics (table and tea wares), glassware, medicine bottles, metal tools, silverware, and personal items including buttons, clothing and shoe grommets and leather, pipe stems and bowls, sewing items, pendants, buckles, children's toys, combs, gun flints, etc., along with structural debris (window glass, nails, door and window hardware, brick, mortar, slate shingles, etc.). Food remains include butchered cow and pig bone, shellfish, and fish bones. The recovered archaeological data will be subjected to laboratory processing and analyses over the next year to address site density, complexity, age, and integrity as well as site-specific research themes relating to the construction and use of domestic and tenement space and lifeways of the mill owners and workers who occupied the site in the nineteenth century.

Erin Timms is an Industrial Archaeologist currently working in Cultural Resource Management in the New England region. Ms. Timms received a M.S. in Industrial Archaeology from Michigan Technological University in 2005 and a B.A. in Art History with a certificate in Historic Preservation from Youngstown State University in 2003. Ms. Timms has a wide range of educational and professional experience relating to the research and interpretation of historic industrial landscapes in the fields of historic preservation, architectural history, and archaeology. Her work in Chepachet Village Middle Privilege site stimulated her interest in the thin line that separate the domestic space from the work sphere in a small rural mill village.

"Poor Shad!": Fishways on Lowell's Pawtucket Dam

Henry David Thoreau sympathized with the plight of the "poor shad" affected by dams in and around Lowell, Massachusetts, in the mid-nineteenth century. The dam at Pawtucket Falls on the Merrimack River was one of the greatest artificial obstacles to fish migrations. Engineers who constructed, reconstructed, and raised the effective height of the dam over time recognized its adverse impact on fisheries but placed more importance on its economic benefits for water-powered industry in Lowell. Fishermen in both Massachusetts and New Hampshire objected to the management of the Pawtucket Dam, and one local group actually took direct action against the structure in 1825. By 1830, there was a fishway on the dam.

In 1847, the Essex Company constructed an even taller dam at Lawrence, ten miles (16 km) downstream. The steep fishway on that dam did not work, thus preventing the annual passage of anadromous fish such as salmon, shad, alewives, and sturgeon. The chief engineer of the Proprietors of Locks and Canals in Lowell, James B. Francis, saw no reason to waste water for fish that were not even reaching Lowell. He ordered his workmen to block up the fishway on the Pawtucket Dam in 1854. Vigorous action by Massachusetts legislators and fish commissioners forced the construction of more effective fishways on the dams in both Lowell and Lawrence in 1867, but overfishing, pollution, and hydraulic turbines continued to take a heavy toll on aquatic life.

The redesigned fishways of 1875, 1921, and 1985 in Lowell did not solve the problems. A fish elevator at the modern hydroelectric power plant on the Northern Canal is now the preferred method for taking fish past the dam. So far, the restoration of substantial fish migration to upstream spawning grounds has been elusive. This presentation will look at the history of the Pawtucket Dam for almost two centuries and at the numerous efforts to move fish safely past it.

Dr. Patrick Malone is Professor Emeritus of American Studies and Urban Studies at Brown University. In addition to serving on the Brown faculty since 1972, he has worked as a metallurgical engineer, taught at the University of Pennsylvania, and directed the Slater Mill Historic Site. The Society for Industrial Archeology elected him as its president in 1982. His research covers the urban built environment, the history of technology, and the archaeology of industry. He is the author or co-author of four books, all of which use material evidence to investigate topics in American history. *The Texture of Industry: An Archaeological View of the Industrialization of North America,* co-authored with Robert Gordon, won a publishing award from the American Institute of Architects. Malone's latest book, *Waterpower in Lowell,* has just won the Neaverson Prize from the Association for Industrial Archaeology in the United Kingdom.

The Historic Flashboard System and the Preservation of Lowell's Pawtucket Dam

For nearly 175 years, the dam across the Merrimack at Lowell has been topped with flashboards, the sacrificial system once common in New England for increasing the head and water storage capacity above its mill dams, while also providing break-away flood relief. This weir-dam spillway system consisted simply of horizontal boards held in place by periodic iron rods set vertically in the top of the dam, and in essence operated automatically by deflecting when impounded water rose to sufficiently above the flashboards. Although of probable vernacular origin, these flashboards were amenable to mathematical analysis. That allowed nineteenth-century engineers to closely design the flashboards to yield in bending at predetermined flood heights.

But after that deflection, the water level remained at the reservoir's lowered level until work crews could rebuild the flashboards. Although this was quickly, efficiently, and cheaply carried out during the textile mill era, in recent years this traditional system has started to be eliminated from the region's historic dams still diverting water for the production of electricity, in favor of the modern technology of a hydraulic air-bladder-operated crest gate.

This presentation will recount the history and technology of flashboards on the Lowell dam, and examine their meaning regarding power production, flood control, and "flowage," the effect on the rights of upriver riparian landowners. It will then examine the significance the dam and flashboards hold for the Lowell National Historical Park, of which they together are a vital component and central to the Park's mission in Lowell to preserve and interpret the historic industrial landscape. Lastly, it will outline the alterations proposed by the dam's private owners to replace the flashboards with a bladder dam and summarize their proceeding attempt to obtain approval for it, and the objections of the Park to the granting of that approval as a matter of federal control.

Charles Parrott is the historical architect with the Lowell National Historical Park, National Park Service. He was trained in architecture at Iowa State University, historic preservation at Columbia University, and on the job with the National Park Service in Washington, D.C., and on several Historic American Engineering Record (HAER) summer recording teams including HAER's first, the Mohawk-Hudson Area Survey in 1969, and the Lowell Canal Survey in 1974 and 1975. During part of the 1970s, he was employed in a private architectural restoration practice, where he was the lead designer for the reconstruction of the Slater Mill's historic waterpower system. He has been a registered architect since 1978 and has been involved in the ongoing restoration and rehabilitation in downtown Lowell and its historic textile mill district since 1980. That has included restoration work on several historic gatehouses of Lowell's canal system and consulting on numerous historic industrial and commercial buildings. His work in Lowell has also encompassed the design and development of the Canalway, a pedestrian greenway system along the city's historic canals.

Why All the Dam Fuss?

Dam operators have devised several mechanisms to address seasonal variations in stream flow, with the goals of maintaining reasonably constant pool elevations for waterpower and navigation while limiting flooding and reducing the chances of catastrophic dam failure during floods. Dam crests carry traditional pin-and-plank flashboards, trip boards, wickets of various configurations, shear struts, bear traps, Tainter gates, sector gates, and, most recently, a number of patented mechanisms based on inflatable bladders. All have had to address issues of reliability, ease of installation and operation, and safety in large swift-flowing rivers that often carry massive quantities of floating debris and ice.

In addition to the technical features of these water control appliances, dam operators also have to contend with legal, environmental, regulatory, and political issues raised by upstream and downstream neighbors, navigation, and fishery interests.

This paper will explore a variety of water control devices that have been added to dams, their operational characteristics, and their role as character-defining features of some historic weirs. It will also examine recent regulatory, environmental, and economic concerns that have made preservation of these structures an increasing challenge in places like Lowell, Lawrence, and other historically significant waterpower sites.

Dr. Duncan Hay works for the National Park Service as hydroelectric licensing specialist for the Northeast Region and as historian for Erie Canalway National Heritage Corridor. Before that he was with the National Building Museum, the Museum of American Textile History, and the New York State Museum, where he was curator of industrial history. He is currently Vice President of SIA. Duncan earned an M.A. and a Ph.D. in the History of Technology from the University of Delaware’s Hagley Program in the History of Industrial America and a B.A. in Geography from SUNY Oneonta. Published works include *Hydroelectric Development in the United States, 1880-1940* (1991). He has also written on the history of waterpower and urbanization, canals, and rural industrialization; organized exhibits on manufacturing, construction, and conservation; and worked with teams from the Historic American Engineering Record (HAER).

Preserving the Innovation Legacy of John P. Parker

John P. Parker played a prominent role in the Underground Railroad network that operated in southwestern Ohio. Many of his exploits as a conductor on the Underground Railroad were refashioned and incorporated into Harriet Beecher Stowe's abolitionist tract, *Uncle Tom's Cabin.* Parker's engineering skills as an inventor and acumen as a businessman have largely been overlooked. Parker's Phoenix Foundry, located in Ripley, Ohio, was one of the largest foundries that operated between Cincinnati and Portsmouth, Ohio. He held two known patents, advertised his inventions widely, and displayed his products at regional and national industrial expositions.

In order to better preserve Parker's industrial legacy, a coalition formed of faculty from the University of Cincinnati's OMI College of Applied Science (OCAS), undergraduate students from the College, members of the John P. Parker Historical Society, and corporate donors in 2006. The Parker Project aimed to produce scale models of Parker's patented inventions that would then be put on permanent display at the John P. Parker Historical Site. This collaborative project revealed new information about the life of John P. Parker and new insights into nineteenth-century foundry and manufacturing techniques. The project experience also underscored the benefits and challenges of bridged partnerships involving academia, nonprofit community organizations, and corporate sponsors.

Dr. Jason Krupar earned his Ph.D. in American Social Policy History from Case Western Reserve University in 2000. He taught for eight years in the OMI College of Applied Science at the University of Cincinnati before joining the University's History Department faculty in the spring of 2010. His past research projects focused on the federal government's historical preservation policies within the nation's nuclear weapons complex. Dr. Krupar's work has appeared in *The Public Historian.* He co-authored a book chapter in *Nuclear Legacies: Communication, Controversy, and the U.S. Nuclear Weapons Complex,* along with writing a chapter that was included in *The Atomic Bomb and American Society: New Perspectives.* His current research project involves unearthing the contributions of African-Americans to the Manhattan Project and the early U.S. Atomic Energy Commission.

The Union Village Pottery: Investigating a Little-Known Shaker Industry

In the spring of 2005, a large archaeological investigation was conducted by Hardlines Design Company and the Ohio Department of Transportation at the site of the North Family Lot, located within the former bounds of Union Village, a large Shaker community in southwestern Ohio that existed from 1805 to 1915. The investigation was spurred by the need to realign a dangerous curve on State Route 741, which runs north-south through the former village location.

Comparison of the curve design with historical aerial photographs and maps revealed that the realignment would impact the archaeological remains of the North Family Lot, one of nine communal loci where Shakers lived and worked at Union Village. The North Family Lot was home to the only known Shaker commercial pottery endeavor, which produced redware vessels and smoking pipes for use by the Shakers themselves and for sale to the outside world to produce needed income to support the community. The Union Village Pottery operated at the North Family Lot from 1836 to 1850, with a previous incarnation operating elsewhere at Union Village from 1824 to 1835.

This paper will present an overview of the Union Village Pottery, its products, and how the pottery operated in the contexts of the local redware industry and within the cultural value system of the Shakers themselves, who valued economy, hard work, and simplicity. Previous research on the material culture of Shakers has stressed the reflection of their values in the designs of their products, but plain and simple ceramic vessels were not always the end product of the Union Village Pottery – possibly a reflection of the need to compete in a wider market rather than focusing on production for internal needs. The archival and archaeological examination of the Union Village Pottery presents a fleeting glimpse of a little-known but important Shaker industry, through which we can increase our understanding of this unique American religious communal group.

Andrew R. Sewell is a principal investigator at Hardlines Design Company in Columbus, Ohio. He graduated with a Master's degree in Industrial Archaeology from Michigan Technological University in 1999. Since then, he has studied historical mill sites, brickworks, and a nineteenth-century sugar plantation pump station. His work at Union Village was part of a Section 106 mitigation effort in conjunction with the Ohio Department of Transportation.

Quality Furniture at an Affordable Price: Reconstructing Nineteenth-Century Business Models

Affordably priced, durable furniture is hard to find in today's market. Furniture offerings are primarily limited to expensive, long-lasting furniture, or inexpensive, disposable furniture. But in the middle and late nineteenth century in America, well-made, desirable furniture was widely available to and affordable for the burgeoning middle class. Much of the furniture that was made over a century ago remains sturdy and desirable enough to be treasured as heirlooms in homes, antique shops, and museums. The business strategies of early industrial furniture makers offer models for the revitalization of mid-priced furniture manufacturing.

Although the buildings and tooling of many nineteenth-century furniture businesses are gone, there is still much that can be discovered in archives and from the furniture itself. This paper proposes a methodology for reconstructing the business strategies of these makers from a material culture perspective, through the deconstruction of their furniture, and the interpretation of business records including account books, trade catalogs, government data, patents, and magazine descriptions of operations. Nineteenth-century industries such as firearms, agricultural equipment, textiles, and shoes, rapidly – and almost uniformly – moved on a path to fully mechanized factory production. But unlike these industries, the furniture buyer demanded a diversity of form and appearance in furniture that could not entirely be met by machine production. Instead of full mechanization, furniture makers who sought to increase the scale of their production combined some industrial processes with flexible hand-craft finishing techniques. The result was higher volume production with a great degree of flexibility in style, form, and selling price.

For example, from 1826 to 1835, David Alling shipped over 17,000 chairs from his shop in Newark, New Jersey. Long before mechanization, Alling's furniture production employed industrial practices including the outsourcing of labor and parts, in-house division of labor, use of standardized parts, and wholesaling. Three elaborately stenciled and turned chairs, several account books, and a painting of his workshop are all that survive. The construction methods and business strategy, however, are deduced by combining the furniture with invoices, shipping records, and an inventory of shop equipment. Alling's strategy included a focused product line (chairs), and low-cost production with flexibility in appearance and price. A similar methodology will be applied to understand the business models of two other early industrial furniture makers, Lambert Hitchcock and Mitchell & Rammelsberg, to show the variety of methodologies for industrially producing affordable furniture.

These makers found ways to manufacture affordable, desirable furniture at high volumes, that was durable and visually compelling enough to be treasured and handed down through the generations. In comparison, the mass-produced furniture hold no continued visual interest and little durability. When veneer peels, plastic deforms, and metal rusts we painlessly discard and replace the furniture, consuming dwindling global resources. Once understood, the strategy used by early factory furniture makers can be applied to the production of furniture using the advanced tools of modern manufacturing to make furniture that is both affordable to a mid-priced consumer and durable enough to last for generations.

P. J. Carlino is an adjunct professor of Product Design at Parsons School of Design, where he teaches several courses in materials, manufacturing processes, and prototyping. His creative practice includes furniture and product design. His academic research explores the interdependence of design, manufacturing, business organization, and social structure. He received his M.A. in the History of Decorative Arts and Design from the Smithsonian Institution's Cooper-Hewitt National Design Museum, a B.F.A. in Product Design from Parsons School of Design, and a B.A. in Chemistry from Rutgers University.

Job Abbott: The Education of a North American Bridge Builder

In July 1885, the Canadian Pacific Railway began crossing the St. John River at St. John, New Brunswick, on a major new steel cantilever bridge. Measuring more than 812 feet (247 m) overall, it is said to have been the first through cantilever bridge in North America. It was also the first major bridge design by Job Abbott, a bridge builder born in Andover, Massachusetts, in 1845. Until this project, Abbott had designed and fabricated smaller iron highway and railroad bridges, first during the 1870s, for the Wrought Iron Bridge Company of Canton, Ohio, and then, beginning in 1882, for the Dominion Bridge Company in Montréal, Canada.

This paper proposes to explore a segment of Abbott's professional career, beginning with his original engineering training as an 1864 graduate of Harvard's Lawrence Scientific School. Following his schooling he worked for several railroads, one of which brought him to the Midwest. Moving to Canton, Ohio, he worked as a surveyor and began studying patent law. His subsequent efforts as a patent attorney brought him into contact with David Hammond, founder of the Wrought Iron Bridge Company. In 1872, he became a vice president and chief engineer of this company. Shortly after the company expanded its territory into Canada, the Canadian government instituted a large tariff on foreign ironwork. In response, a subsidiary Canadian firm was organized, but when it faltered, Abbott moved to Montréal and founded the Dominion Bridge Company. Shortly thereafter, Abbott began designing the St. John Bridge. We propose to explore the process by which Abbott became the designer of an innovative, multi-component, long-span railroad bridge.

David A. Simmons, editor of *TIMELINE* at the Ohio Historical Society, holds two degrees from Miami University and, since joining the Ohio Historical Society in 1976, has been active in public and private efforts to preserve historic engineering structures. While employed by the Ohio Historic Preservation Office, he worked closely with the National Register of Historic Places and Section 106 review processes and was an advisor and contributing writer for four statewide historic bridge inventories prepared by the Ohio Department of Transportation. He helped assemble the program of eight historic bridge conferences. Simmons is president of the Ohio Historic Bridge Association, for whom he oversaw the restoration of a covered bridge in 1998. His article, "Bridges and Boilers: Americans Discover the Wrought-Iron Tubular Bowstring Bridge," published in *IA,* Vol. 19, No. 2, received the Norton Prize for outstanding scholarship in industrial archeology in 1995.

Dr. Dario Gasparini is a professor of civil engineering at Case Western Reserve University. He has published on the history of structural engineering with a particular focus on prestressing technologies. He has authored and presented papers at the three International Congresses on Construction History, SIA annual meetings, and Transportation Research Board annual meetings. Gasparini has conducted numerous engineering studies for the Historic American Engineering Record since 1996. He chairs the History and Heritage Committee of the Cleveland Section of the American Society of Civil Engineers (ASCE), and is a corresponding member of the national ASCE History and Heritage Committee.

A 150th Anniversary History of the Phoenix Column

This paper takes a fresh look at the history of the Phoenix column on the 150th anniversary of the U.S. Patent issued in June 1862. The Phoenix column was a hollow, circular, wrought-iron (occasionally steel) section, built up from three to eight segments, riveted together at the flanges. In its day, it was known for its advantages in constructing building frames, towers, ocean and bridge piers, and bridge trusses. It was popular for about thirty to forty years before fading into historical obscurity, yet not before playing an important role in thoroughly convincing engineers and architects of the structural inferiority of cast iron.

The evidence is unequivocal that the Phoenix column was first fabricated at the rolling mill of the Phoenix Iron Company in Phoenixville, Pennsylvania, but the basis of the column's invention is less clear. Jacob H. Linville, the Pennsylvania Railroad's Chief Bridge Engineer, claimed that Samuel Reeves, Vice President of the Phoenix Iron Company and the column's patentee, stole the idea from him. Linville had sketched out the idea for a hollow-section wrought-iron column for use with the Arsenal Bridge over the Schuylkill River in 1860 or 1861. Linville had patented features of that bridge six months before Reeves took out the patent for the Phoenix column. Reeves pointed to other sources of inspiration for his patent including iron ship masts. Both men attempted to expand upon their respective claims, in essence arguing that their patents gave them wide-ranging rights to the idea of fabricating built-up structural members from channels, angles, bars, and plates. A lawsuit brought by Linville and countered by Reeves essentially ended in a stalemate, although Reeves and the Phoenix Iron Company retained the right to the distinctively shaped Phoenix column. The Phoenix Bridge Company was an outgrowth of Reeves' efforts to develop a market for the column. This presentation is illustrated with images and statistics from business records, trade catalogues, and surviving examples of buildings and bridges. Some concluding thoughts are offered on approaches to preserving Phoenix columns.

Patrick Harshbarger (M.A., M.P.A.) is Principal Historian at Hunter Research, Inc., in Trenton, New Jersey, where he currently oversees historic research and architectural history. Patrick has had an interest in the Phoenix column since 1990, when he worked on a Historic American Engineering Record (HAER) project documenting bridges in Massachusetts. After graduating from the University of Delaware's Hagley Program in 1991, he worked as the bridge historian at Lichtenstein Engineers until moving to his current position in 2010. He has been an enthusiastic member of the SIA since 1986 and the Society's newsletter editor since 1995.

Electric Dreams and Retro Futures: The Legacy of Nikolai Tesla in Historical Memory and Popular Culture

From his journey to Mars alongside Thomas Edison in J. Weldon Cobb's 1901*To Mars With Tesla* to his 2008 appearance as an electrokinetic vampire on the Canadian science fiction show *Sanctuary,* Serbian-American electrical engineer Nikolai Tesla has appealed to twentieth- and twenty-first-century writers of popular fiction, and historians of science, far more than he was ever able to appeal to investors and the general public in his own lifetime.

This paper will examine Tesla's manifold appearances in popular fiction and cultural memory, ranging from roles in early Edisonades at the beginning of the century, through the birth of dieselpunk and steampunk in the 1980s and 1990s, to Tesla's rediscovery as a national hero for Serbians and Serbian-Americans in the late twentieth and early twenty-first centuries. Tesla has been both hero and villain in the popular memory, appearing as both the ur-mad scientist and the first of the great Romantic heroes of science fiction.

I will argue that Tesla has been uniquely suited to play the part of science-fictional protagonist for a wide range of fictional authors because of how well the details of Tesla's own life, his eccentric, anti-social personality, his fascination with grand, sometimes baroque, scientific projects, and the tragic details of his personal and professional life, played to the common tropes of twentieth-century science fiction. For writers of a genre frequently exemplified by lone science heroes laboring in their isolated laboratories to improve the betterment of mankind (or to build a death ray), Nikolai Tesla was proof that sometimes science fiction could become science fact.

Men like Thomas Edison might have been acclaimed as safe American heroes in the twentieth century, but as the nature of our public relationship has changed, we are far more likely to embrace the misunderstood genius than the successful entrepreneur. Additionally, Tesla's memory has provided a safe national hero to his native Serbia and to Serbian immigrants living in the United States. The Romantic ideal of the science hero, laboring alone in his laboratory and accomplishing great deeds, has proved a more attractive vision of the past for contemporary Serbians than politically controversial figures that might call back to the Communist, monarchist, or nationalist past. Whether in the public memory of science, use of historical characters in fiction, or in nationalist historical memory, the Romantic scientist exemplified by the memory of Nikolai Tesla has proved a steadfastly attractive ideal for people through much of the twentieth and twenty-first centuries.

Michael Davis is a fourth-year Ph.D. student at the University of Cincinnati. He is a graduate of Northern Michigan University and the University of Chicago, having worked with Jon Saari and Kathleen Conzen at both institutions. While primarily a historian of nineteenth-century American politics, particularly how religion and politics became wedded together in the 1830s, he has a strong personal interest in the history of science fiction, both future and past. This applies to both the "paleo-futures" of the past, how people of the nineteenth and early twentieth centuries envisioned the scientific utopia most of them saw coming in the new millennium, and the way history has been interpreted by science fiction writers as part of the late twentieth-century "historypunk" movement.

Prestressed Concrete Box Beams

Introduction by Mary McCahon, Session Moderator

No material had a greater influence on bridge construction during the last half of the twentieth century than prestressed concrete. Brought to this country from Europe immediately after World War II, prestressed concrete bridge technology established itself as a viable alternative to steel and by 1980 had surpassed steel as the bridge material of choice by many state departments of transportation and municipalities. The new material fascinated bridge designers and fabricators alike, and they used technological advances in prestressing strand by John A. Roebling's Sons Company (JARSCO) to develop their ideas for economical and efficient precast, pretensioned beams. This session reviews the early development of the prestressed concrete bridges through early applications in Tennessee, Ohio, Michigan, and Pennsylvania, where the oldest and most technologically significant examples remain, and the significance JARSCO's development of high-strength wire products played in the rapid adoption of the technology.

Charles C. Sunderland, the John A. Roebling's Sons Company, and the Development of Concrete Prestressing Technologies in the United States

The John A. Roebling's Sons Company (JARSCO), under the leadership of Charles C. Sunderland, began research on prestressed concrete in 1942. Sunderland foresaw that prestressed concrete would become a competitive technology that required high-strength wire and strand, JARSCO's principal products. In a conscious effort to provide leadership to the nascent field, Sunderland developed a completely American post-tensioning system using compact swaged connections, anchorages, and post-tensioning equipment. Sunderland advocated a philosophy of using galvanized and accessible post-tensioning tendons. In collaboration with professional engineers, JARSCO also developed complete bridge designs, first notably for the Walnut Lane Bridge in Philadelphia. The contributions made by JARSCO engineers, especially Sunderland, were essential for the growth of the prestressed concrete industry and remain significant to this day.

Dr. Dario Gasparini is a professor of civil engineering at Case Western Reserve University. He has published on the history of structural engineering with a particular focus on prestressing technologies. He has authored and presented papers at the three International Congresses on Construction History, SIA annual meetings, and Transportation Research Board annual meetings. Gasparini has conducted numerous engineering studies for the Historic American Engineering Record since 1996. He chairs the History and Heritage Committee of the Cleveland Section of the American Society of Civil Engineers (ASCE), and is a corresponding member of the national ASCE History and Heritage Committee.

In Honor of Ordinary Bridges: How the Adjacent Box Beam Came to Dominate Secondary Road Bridge Construction

The need for stronger economical secondary road bridges after World War II led bridge engineers and fabricators to develop some interesting approaches to applying the concept of prestressing to beam design. Ideas that were being developed in Tennessee, Pennsylvania, and Michigan resulted in the box beam design that is ubiquitous today and show how the new technology came to be adopted as a state standard design. The presentation explains why some examples of seemingly unimpressive bridge type are seminally significant and the different ways the new technology was picked up by designers and fabricators eager to build stronger and more economical bridges, including life-cycle considerations. The adjacent box beam design that became the standard design was developed in Pennsylvania as a byproduct of promoting the first and most famous prestressed concrete bridge in America, the 1949-1951 Walnut Lane Bridge in Philadelphia.

Mary McCahon has been a historian with Lichtenstein/TranSystems for twenty-five years and has conducted research and evaluations on old bridges types in many states, including Tennessee, Ohio, Pennsylvania and Michigan. She has also co-authored AASHTO guidance on rehabilitation of historic bridges and construction of new bridges in historic settings and several state maintenance guidance manuals.

An Irresistible Force: How Ohio DOT Came to Accept the New Technology

Prestressed concrete was not universally embraced as the technology of the future. The Ohio experience is emblematic of the transition from the era of experimentation and the reluctance of owners and transportation officials to utilize the new technology. It illustrates the pivotal role that visionary locally based bridge engineers and the industry (beam fabricators) played in having prestressed concrete bridge designs adopted as state standards. Discussion will include historic context for the oldest extant prestressed concrete I-beam bridge in the nation and the role of the state's Department of Transportation in adopting the new technology.

Tom Barrett is the manager of Ohio's award-winning historic bridge program that focuses on education and interagency operation to promote knowledge about and the proactive stewardship of the state's remarkable collection of historic bridges. He has been with the department for fifteen years and has guided the state's last two bridge surveys. Tom is also an enthusiast and custodian of vintage vehicles of all scales, and slowly becoming the unofficial repository of obsolete office equipment at the DOT.

Vancouver SRO Hotel Construction Evolution

Between 1897 and 1913, Vancouver, British Columbia, experienced an unprecedented building boom, partially due to the city being the new western terminus to the Canadian Pacific Railway, but also due the explosive regional development of the resource extraction industries. Vancouver attracted a large itinerant labor force that worked seasonally in the fishing, forestry, mining, and manufacturing industries. Scores of single room occupancy (SRO) hotel and rooming houses were constructed throughout the city's current Downtown East Side, encompassing Gastown, Japantown, and Chinatown areas. These were typically speculative mixed-use developments, providing for commercial or retail storefront tenancies, and rooming house accommodation in the upper floors, typically with shared bath and toilet facilities. Numerous support service industries, such as restaurants, bars, billiard halls, brothels, and laundries provided the predominantly male population their needed services. Many of these developments were substandard, and the City of Vancouver introduced the 1910 Rooming House Bylaw to ensure proper sanitation, access to light and ventilation, and basic fire separation requirements were observed.

Vancouver's Downtown East Side has developed into Canada's poorest neighborhood, with a large percentage of the poor, many coping with substance addiction and mental health problems, residing in these early twentieth-century SRO hotels. The preponderance of slumlord-operated SRO hotels resulted in the Province of British Columbia purchasing twenty-three of these hotels, through its social housing corporation, BC Housing.

Building on the success of the first nine rehabilitations, BC Housing is embarking on a full rehabilitation, including exterior restoration and limited seismic upgrade, of the remaining thirteen, through an innovative 3P (public-private partnership) delivery process. Although somewhat common in Europe, this is purportedly the first 3P of heritage SRO hotels on this scale in North America. As part of the Request for Proposals from 3P proponents, approved Conservation Plans were put in place, and detailed existing building investigation reports were developed.

This paper will examine the interesting evolution of construction and structural techniques in Vancouver's SRO hotel development, from the pre-1886 Vancouver fire, of wood frame hotels, to the predominantly mill construction buildings, of brick, heavy timber, and solid laminated wood floor construction, to interesting hybrids incorporating steel framing and mill construction, to cast-in-place concrete construction.

As in many rapidly developed, frontier cities, an air of architectural respectability was achieved through the crowning of many of these buildings with elaborate ornamental sheet metal cornices. Existing and restored sheet metal cornices will be explored. Cast iron, wood frame, and terra cotta-clad storefronts of the twenty-three SRO buildings will be explored, some restored, and some scheduled for restoration. Simple wood double-hung windows evolved toward Chicago-style center pivot windows with hopper transoms, and window rehabilitation will be touched on.

The paper will provide a glimpse into the evolution of construction of a particular regional building type, demonstrating remarkably quick development during a period of frontier boom.

Barry McGinn is a consulting engineer and registered architect who holds a Master of Science in Historic Preservation degree from the University of Oregon. His firms, McGinn Engineering & Preservation Ltd. and Barry McGinn Architect, are located in Vancouver, British Columbia, and focus on heritage building conservation/restoration and industrial heritage. Over nineteen years of practice, projects have ranged from historic steam-powered saw mill restoration (McLean Mill National Historic Site equipment restoration and construction management) to historic mine camp stabilization (Hedley Mascot Historic Site) to many heritage building rehabilitation and restorations.

Disappearing Icon: The Pennsylvania Turnpike's Rigid Frame Bridge

The Pennsylvania Turnpike, constructed between 1938 and 1940 and expanded in the post-World War II era, is historically significant as the nation's first-high speed, limited-access, long-distance superhighway. While not generally known for its design beauty or aesthetics, the Pennsylvania Turnpike has at least two features of artistic note: its stone rest area buildings; and its Art Moderne-inspired rigid frame reinforced concrete overhead bridges. Both resource types are disappearing as the result of a project to upgrade the Turnpike to three lanes in each direction.

The presentation will examine why the Pennsylvania Turnpike Commission chose reinforced concrete rigid frame bridges, a relatively uncommon bridge type in America at the time, for most of the Turnpike's overhead bridges. The stated desire of obtaining "the best architectural treatment without undue expenditure" belies a contentious internal debate that took months to resolve. The choice of single-span, rigid frame bridges was based on a number of factors, including engineering and safety considerations, logistics, and the goal of using a modern design combining strength, economy, and beauty.

The presentation will also briefly explain why the engineering and economics of rigid frame bridges appealed to the Commission, and present in detail the two Art Moderne-inspired rigid frame designs adopted by the Commission. The first design emphasized end pylons on the abutments and a deck that had the appearance of a restrained beam with curved soffits. The second stressed wings battered outward and a plain surface on the exposed portion of the frame. Bridge parapets were meant "to obtain the maximum of simplicity" regardless of which type was used. Finally, the presentation will also address the constraints the bridges imposed on widening the road, which will lead to their eventual demise.

Gerald M. Kuncio is the Senior Historian in the Cultural Resources Service Group of Skelly and Loy, Inc., an environmental engineering consulting firm with offices in Harrisburg; Pittsburgh; Morgantown, West Virginia; and Hagerstown, Maryland. He holds a Master of Arts degree in American History from University of Delaware and a Bachelor of Arts, also in American History, from Duquesne University. Gerry has prepared National Register of Historic Places (NRHP) and National Historic Landmark nominations, Historic American Engineering Record (HAER) and state-level documentation, determinations of NRHP eligibility, and determination of effect reports. He has served as a historian and field surveyor on two statewide historic bridge inventories and evaluations, co-authored a management plan for 124 stone arch bridges in the greater Philadelphia region, and discussed Pittsburgh's world-famous bridges on the History Channel's program *Modern Marvels.*

The Semiconductor Industry: Its Development, Rapid Changes, and the Urgent Need for Archaeological Preservation

Although semiconductors were known before 1900, the industry only blossomed with the invention of the transistor in 1947 and the microcircuit in 1960. Semiconductors, and the communications and computer revolutions they spawned, have since transformed our world. Telephone and consumer electronics existed before the transistor, but could never have developed as they did without the microcircuit. Every year, microcircuits become smaller, cheaper, and more complex through continuous process improvement and by disruptive technology. Use of higher electromagnetic (EM) frequencies, made possible by the smaller transistors, permitted small antennas that in turn led to handheld mobile devices like phones and GPS. Cell phones containing billions of transistors allow efficient and affordable communications in developing countries by eliminating the huge costs of wired infrastructure. Data traffic within any EM bandwidth has increased to a density not dreamed of forty years ago due to the complex circuitry now commonplace.

This paper will trace the changing U.S. semiconductor business model from transistor manufacture in simple factories owned by existing electronic equipment manufacturers, through vertically integrated specialist microcircuit manufacturers like Fairchild using parallel production in custom-built facilities, to the present "fabless" manufacture where actual production is offshore.

In early days, transistors were produced individually using labor-intensive methods with low yields and poor reliability. Costs were high despite manufacture in corners of existing factories and low infrastructure and equipment overheads. Microcircuits are now manufactured with hundreds of microcircuits simultaneously fabricated on a 300-mm "wafer" to lower unit costs. Microcircuits are produced in specially built foundries costing billions of dollars, with cleanliness far exceeding best hospital practice. Manufacturers use automated repetitive sequences of thin layer depositions, precision shaping using optical lithography, dry etching, and ion implantation to introduce the critical "impurities" and geometries which give microcircuits their electrical properties. None of these processes were used in the original transistor manufacture. The bounds of practicality and perceived theoretical limitations are pushed back regularly, often requiring abrupt changes in manufacturing technology. Transistor areas typically halve every two years according to the notorious Moore's Law. Price reduces proportionately and ultimate performance doubles each technology generation. Electronic products are now throwaway items.

This has led to a preservation crisis. The microelectronics industry viewpoint is that no plant or piece of equipment has value or is worth preserving if it no longer can produce the latest cheapest devices. Most microelectronic products are disposable. From an industrial archaeology viewpoint, this is a disaster. Product life is a year or two. Most equipment is scrapped within five to seven years. Little remains of many historical manufacturing sites. Soon the engineers and technicians who understand the old processes and worked in the old factories will be gone. This paper is a plea for the IA fraternity to wake up and preserve historical evidence of, products, processes, equipment, and buildings of this rapidly evolving industry.

Dr. Ray Haythornthwaite has degrees in chemistry and electronics. He has worked in the semiconductor industry for almost fifty years from germanium transistor production, through microcircuit development, to owning a company responsible for demonstrating the physical reliability of microcircuits used in space programs. He is a longtime member of SIA and has an interest in the history of semiconductors and their production, and preserving historical semiconductor artifacts.

Hurricane Irene's Impact on Covered Bridges

In August and September 2011, tropical storms Irene and Lee hit the northeast United States While weathermen stationed themselves along beaches and lowland urban areas, the real damage occurred inland, raising rivers and streams in New England to record levels. This high water impacted several rural areas of Vermont, New Hampshire, and New York, affecting several covered bridges.

This presentation will study various covered bridges as case studies that suffered different fates in the aftermath of the storm damage. Research was conducted through interviews with a town manager, timber framer, engineer, and preservationists involved with some of the bridges affected by the storms. Among the bridges studied will be the Blenheim Bridge, a National Historic Landmark that was completely lost; Hall's Bridge, which suffered damage but has already been repaired; and the Bartonsville Bridge, a YouTube sensation, which will be salvaged and replaced by a new covered bridge.

The paper will also assess the emergency preparedness of the bridge owners, discuss lessons learned, and offer challenges and suggestions for protecting these historic structures from future natural disasters.

Christopher H. Marston is an architect with the Historic American Engineering Record of the National Park Service. He started by documenting steel mills in the Monongahela Valley in Pittsburgh in 1989, and has been in HAER's Washington, D.C., office since 1994. He has led teams on a variety of transportation and industrial sites such as railroads, historic roads, canals, and covered bridges to waterpower, irrigation, mining, and aviation sites. He is co-editor of the award-winning book, *America's National Park Roads and Parkways: Drawings from the Historic American Engineering Record,* and served as associate curator for the traveling exhibition, *Covered Bridges: Spanning the American Landscape,* produced by the Smithsonian Institution. He has been project manager of HAER's multi-faceted National Covered Bridge Recording Project since 2002, and is chair of the upcoming National Covered Bridge Conference in Dayton in June 2013. He serves as a board member of Preserving the Historic Road (chair), the Transportation Research Board Committee on Historic and Archeological Preservation in Transportation (ADC50), and the Montgomery County (Maryland) Rustic Roads Advisory Committee. An active member of SIA since 1991, he chaired the Pittsburgh and Washington, D.C., conferences, coordinated the Scotland and Sweden study tours, and served on the Board of Directors and Nominations Committee.

Relocation and Rehabilitation of Historic Trusses on Alum Creek Trail

As we replace our aging bridge infrastructure, historic icons are disappearing at an alarming rate. Bikeways and trails make good venues for restoration of bridges, but costs and funding limitations can prevent their reuse. The main catalyst is owners who are willing to put the time and funding into restoring these bridges. Two bridge projects are presented to discuss their reuse on the Alum Creek Trail, the Wheeler Mill (a.k.a. Bridgeview) Truss and the Beach Road (a.k.a. Westerville) Truss.

For the ongoing Alum Creek Trail project, the City of Columbus Park and Recreation Department has required that a variety of bridges be placed on the trail so that these structures become part of the trail's attraction. This philosophy has led to the recent discovery and re-erection of the 1900 Wheeler Mill Bridge bowstring truss from Scioto County, which was removed from service in 2003.

The Wheeler Mill/Bridgeview Truss is a 153-foot-long, single-span through truss, and its design is an unusual hybrid between a bowstring and camelback truss. At the time of its removal, it was eligible for the National Register of Historic Places. While investigating potential trusses for reuse at Wendy Park in Cleveland, Jones-Stuckey looked into U.S. Bridge inventory of dismantled bridges, or bone yard. Following inspection of the members and successful negotiations, rehabilitation plans were developed for the structure. A new floor system was designed and upper lateral bracing was replicated in kind. Approximately 60 percent of lower-chord eyebars were replaced due to cracks identified at the forge welds. A few eyebars were repaired. These discrete modifications have restored the truss to an H15 loading required for the trail. This is the second truss bridge that has been restored along the Alum Creek Trail.

In 1999, Jones-Stuckey developed plans for the replacement of the Beach Road/Westerville Truss over Big Darby Creek. This truss was a double-intersection Whipple truss built in 1888. Because of its eligibility for inclusion on the National Register of Historic Places, the Franklin County Engineers Office (FCEO) offered the City of Westerville the truss for their portion of the trail. As an environmental mitigation project, Federal Highway Administration funding was obtained for the dismantling, moving, and erection of the truss. FCEO paid 20 percent of this cost and the City of Westerville paid other costs.

The different ways in which these two bridges were built demonstrate their respective contractors' ingenuity in devising construction methods. The Beach Road/Westerville Truss was designed to be assembled off the new abutments and rolled into place. The restoration contractor chose to build it in place using original methodology. The Wheeler Mill/Bridgeview Truss was designed to be built in place, but the restoration contractor chose to assemble it off the new abutments and roll it into place.

New materials were integrated into the old bridges to protect against loss of historic integrity, thus prolonging these bridges' lives and lowering their maintenance costs. Stainless steel pins were used to reduce the potential for pack rust in this area. An IZEU three-coat paint system provides protection for the steel and iron, and elastomeric bearing pads replace the original nested rollers and bolsters.

The presentation concludes with a discussion of what to look for in the restoration of these bridges, where problem areas were encountered, and what cost can be expected on similar restoration projects.

David W. Jones, P.E. is President of Jones-Stuckey, a 31-person civil and structural engineering firm practicing in Ohio. Mr. Jones directs the staff of engineers and technicians in the design and construction of bridges, highways, and civil engineering projects. In his 33-year career, Mr. Jones has been responsible for the rehabilitation of numerous historic structures throughout central Ohio, including Richland Avenue, City of Athens; Lithopolis-Winchester Road, Franklin County; the Beach Road/Westerville Truss, Franklin County/City of Westerville; and Streng Road over Big Darby Creek, Union County. Mr. Jones has been a member of the American Society of Highway Engineers since 1984 and currently serves as National Treasurer.

Brilliant Bridge Restoration

Queen Victoria of England facilitated forced removal of the Dookabor community, a pacifist religious sect from Czarist Russia at the turn of the twentieth century, through immigration to western Canada. A large group settled in Castlegar, British Columbia. In 1912 they were awarded a provincial grant, which covered materials and bridge engineering to build a new suspension bridge across the Kootenay River and connect two villages near Castlegar. One hundred male community volunteers labored under the on-site supervision of a young engineer from an established firm in Vancouver to construct the 330-foot (100-m) suspension span in 1913. The opening was commemorated by a procession of the entire community over the bridge, led by the group's religious leaders.

In 1965, a new steel arch highway bridge was constructed across the Kootenay River, and the suspension bridge fell into disrepair. A train derailment resulted in the burial of the northeast set of four main bridge cables and their subsequent exterior corrosion.

The Brilliant Bridge Restoration Committee, comprised of local Dookabors, was formed in 1991. With the help of a provincial bridge restoration design grant, they advanced the project to a point where the local regional government, the Regional District of Central Kootenay (RDCK), assumed ownership of the site from the Department of Highways. This attracted sufficient federal, provincial, and local industrial funding to kick off the restoration project in 2010.

AECOM provided the structural engineering analysis and was able to determine that the current load-carrying capacity was acceptable, albeit with some preservation actions. The curving heavy timber trestle approach was reconstructed in the spirit of the original design and construction, with original drawings providing guidance for robust oversized members in the original configuration. As this is now part of the Trans-Canada Trail, which was one of the funders, sensitive adjustments were made to the approach guardrails to accommodate bike heights, but still be in keeping with the original guardrail design. The open deck truss needed enclosure for safety reasons. A steel angle frame accommodating a proprietary welded wire mesh clip system integrates well with the standard structural shapes of the deck truss. The buttress beams partially embedded into the concrete tower decks had been crushed, reportedly by caterpillar tractors traversing the suspension bridge during construction of the 1965 bridge. These were dug out and replaced with new hot-dip galvanized beams. The bridge's structural steel was sequentially encapsulated, blasted for removal of lead-containing paint, and given a new three-coat epoxy-based coating. The bridge was then re-decked in ACQ-treated Western Douglas Fir beams and deck planks.

Poor detailing of the original suspension rods resulted in accumulation of debris and corrosion of the suspension rods at the beam bearing plates. A local steel fabrication firm devised an effective bottom rod replacement strategy that allowed the affordable replacement of nearly half of the suspension rods, through a system of new rod bottoms and coupling to the existing rods.

The bridge opened on the 2011 Victoria Day long weekend with great fanfare with the entire local Dookabor community, some 1,200 strong, re-enacting the original opening procession across the bridge.

Barry McGinn is a consulting engineer and registered architect who holds a Master of Science in Historic Preservation degree from the University of Oregon. His firms, McGinn Engineering & Preservation Ltd. and Barry McGinn Architect, are located in Vancouver, British Columbia, and focus on heritage building conservation/restoration and industrial heritage. Over nineteen years of practice, projects have ranged from historic steam-powered saw mill restoration (McLean Mill National Historic Site equipment restoration and construction management) to historic mine camp stabilization (Hedley Mascot Historic Site) to many heritage building rehabilitation and restorations.

The Demise of a Mid-Nineteenth Century Iron Blast Furnace: The Mill Creek (Trumbull) Furnace in Youngstown, Ohio

Iron was the plastic of the early nineteenth century. It could be found in every room in the home and was central to the country's two greatest economic activities of the period: agriculture and manufacturing. The demand for iron in newly settled areas was sufficient to draw entrepreneurs to urban areas into the Ohio Country. One family of entrepreneurs, the Heatons, built and maintained blast furnaces in Ohio's Mahoning Valley. One of their blast furnaces, the Mill Creek (Trumbull) Furnace was excavated in 2003-2005 by John R. White of Youngstown State University. Historical records are vague about the furnace's operations, but one source indicates that a lack of access to transportation was to blame for the failure of the furnace. The author used portable x-ray florescence (pXRF) on the final iron products created at the furnace to determine the amount of sulfur, an element that in large quantities can make the iron brittle and less commercially valuable.

My intention is to use the pXRF on a piece of iron that came from the last load of iron the furnace produced. This last load of iron (known as a salamander or bear) was discovered during excavations at the Mill Creek (Trumbull) Furnace during the 2003-2005 excavations. The goal is to account for the amount of sulfur in the iron ore, relative to the entire sample. When the shift in fuel source from charcoal to bituminous coal occurred during the lifetime of this furnace, the coal that was used added a lot more sulfur to the finished iron products. Anything over a very small percentage of sulfur makes iron brittle. Since cast iron is difficult to weld back together with current technology, and would have been unweldable in the nineteenth century, this would have made any cast iron with high sulfur content less economically desirable. In current blast furnaces, extra sulfur can be removed from iron by adding a proportional amount of manganese; however, this technique was little understood by the first generation of blast furnaces in the Mahoning Valley.

David Parker is a graduate student pursuing a Master of Science in Anthropology at the Mercyhurst Archaeological Institute at Mercyhurst University under the tutelage of Dr. James M. Adovasio. His current interests involve nineteenth-century ironworking, Caribbean prehistory, and fiber perishable studies. He graduated from Youngstown State University with an A.B. in 2007, where he worked with the late Dr. John R. White. Having previously excavated at the Mill Creek (Trumbull) furnace, he is currently working on the excavations at Springfield (Seth and Hill) furnace, south of Mercer, Pennsylvania.

From Doctrine to Protocol: Placing an Early Twentieth-Century Brick Press in Preservation

For doctrinal statements to be effective, they must result first in standard procedures for evaluation, and then in standard practices guided by formal protocols. Historic conservation continues to lag in this last respect. A case history is reported to focus on the problem.

The premises at 550 Bayview Avenue in Toronto were in continuous use as a brickyard from 1889 until 1989, when the entire site comprising a quarry and an "industrial pad" with a number of structures and remnant equipment was acquired by the Metropolitan Toronto and Region Conservation Authority. In 2010, Evergreen, an environmental educational charity, contracted for the adaptive reuse of the site to accommodate its national headquarters. During the first phase of rehabilitation, an early twentieth-century soft mud brick press was placed in preservation.

In applying standards, as formulated for example in the Parks Canada *Standards and Guidelines for the Conservation of Historic Places,* it is necessary to develop an analytic framework to treat the particulars of each case. Preservation of the brick press, a Martin A machine, was viewed as a balancing of two sets of concerns: 1) historic integrity, public safety, long term stability, and costs; and 2) documentation, display, interpretation, and costs.

On investigation the press was found to be composite in materials and in period of construction; that is, a historic core had been retrofitted with auxiliaries to automate the process more fully. The implications for conservation and interpretation are discussed.

In conclusion the adequacy of the analytic framework is assessed, and a formalized permitting process for interventions in a conservation context is suggested, analogous to the "hot work permit" that is required on construction sites. A model of such a permit is proposed.

Shawn Selway is the principal of Pragmata, a company offering consulting and technical services for the custodians of historic machinery. He has a B.A. in Religion from McMaster University and completed his millwright apprenticeship in the Steel Company of Canada's basic works in Hamilton, Ontario. In addition to his preservation work with Pragmata, he has been employed as a millwright on projects at a lead mine in Bathurst, New Brunswick; an oilseed plant in Lloydminister, Saskatchewan; a phosphate plant in Coatzatcoalcos, Vera Cruz; and many others. His book on the mass evacuations of tuberculosis patients from the Eastern Arctic to a sanatorium in southern Ontario during the 1950s is currently under consideration by the University of Alberta Press.

The Schuylkill River Desilting Project: Documentation and Evaluation

Constructed between 1947 and 1951, the Schuylkill River Desilting Project was the first project to result from the Pennsylvania Clean Streams Law (Act 394) and was also the first major environmental clean-up project in the United States. The project had two specific goals: 1) stop future pollution and; 2) clean up current pollution in the Schuylkill River. Industrial pollution, particularly the residues of the anthracite coal industry, had caused the cessation of navigation, an increase in flood hazards, and an abandonment of the use of the Schuylkill River for recreation. The river's value as a source of domestic and industrial water supply became seriously impaired. The Schuylkill River Desilting Project is significant in the history of environmental protection and remediation, as it was the "first large-scale cleanup of its kind and helped usher in an environmental revolution" (Catalano and Zwikl 2009).

In addition to the environmental actions behind the Schuylkill River Desilting Project, it is an excellent example of a comprehensive solution to a complex series of social, industrial, engineering, and legal issues. The engineering and technological challenges and solutions of the project make it innovative and unique and the overall advances that it created in the field of coal remediation were the foundation for similar projects.

Evaluating the Schuylkill River Desilting Project for eligibility for the National Register of Historic Places was undertaken at the request of the Pennsylvania Department of Transportation as part of an ongoing highway project in Chester County, Pennsylvania. The methodology developed and employed for the survey and documentation of this resource has set a new standard for the evaluation of large-scale linear, industrial, and transportation resources within the state of Pennsylvania.

Actively used until 1973, and passively used since then, the Schuylkill River Desilting Project provides a unique look at documenting and evaluating the significance of a resource that embraces the more ephemeral nature of a movement (the environmental movement).

Mary Alfson Tinsman is the Director of Historic Preservation and Business Management at Cultural Heritage Research Services, Inc. (CHRS). She has a M.S. in Historic Preservation from the University of Pennsylvania and an MBA from DeVry University. Ms. Tinsman has conducted cultural resource studies throughout the United States including projects in Pennsylvania, Maryland, Delaware, and South Dakota.

Documentation to the Secretary of the Interior's Standards: Assessing the Value of Laser Scan Data

The National Park Service's Heritage Documentation Programs (HDP) consider High-Definition Surveying (HDS) to be a significant tool, one of many it employs in the survey of historic sites and structures. However, this technology by itself is limited in its ability to provide adequate information to completely document heritage sites to the high standards recognized today by the preservation community. HDP have utilized terrestrial laser scanning in documenting cultural heritage through experimentation and application of the technology since 2002 and continues to incorporate its use extensively into their workflow. With a mission that places emphasis on creating an archival record, HDP strive to supply project sponsors with a comprehensive set of deliverables that convey an understanding of a site or structure to the general public; interpret its processes, patterns of use, and cultural values; and provide baseline documentation for rehabilitation and restoration. Research and data capture necessary to fully describe historic architectural resources requires an understanding of the principles and the history of architecture to help define, manage, and guide the documentation effort. The trained staff of architectural historians, architects, landscape architects, and engineers at HDP provides a discerning eye to projects to make informed decisions from laser scan and field data that ensures knowledgeable and sound documentation. This multi-disciplinary expertise is also utilized in the HDP summer intern program to mentor and educate the next generation of architectural preservationists, providing longevity to the many techniques and methodologies of documenting our cultural heritage.

As laser scanning greatly reduces the time needed in the field for measuring, it also tends to reduce physical contact and exploration of a site that can uncover or expose unexpected features not readily seen. While it remains virtually impossible to capture 100 percent of a site or structure with laser scanning alone, combining HDS with other measuring techniques and extensive research has proved to be an effective means of gathering field measurements and data that reinforce thorough documentation. In addition to supporting large-format photographs and historical reports, the creation of standardized, conventional drawings facilitates strict archival stability standards and the public and scholarly dissemination of the documentation. HDP use supplemental data to fill in the blanks left by laser scanning, allowing for the reverse engineering of point clouds into smarter parametric two-dimensional drawings, three-dimensional solid models, meshes, and surfaces. These models and other visuals created during the project workflow can be manipulated to provide a multitude of products determined by the sponsor's needs. The printed reports, photographs, and drawings become the archival material that will secure exceptional permanence for the documentation while the digital data remain at this time unconventional and unverifiable entities. The Library of Congress and others are researching methods and formats in which to sustain "born digital" records to standards defined for the collection, but at this time none have been proposed.

The emergence of new digital HDS technologies has increased the ability to measure heritage sites faster than ever before, but a hasty application of these technologies can easily result in superficial and incomplete documentation of the significant features of a structure or site. To achieve well-examined, thoughtful, and comprehensive documentation, laser scanning must be supplemented with additional field measurements and observations and receive specific evaluation and translation by professionals in the field of historic preservation.

Dana Lockett is an architectural project manager with the National Park Service's Historic American Engineering Record in Washington, D.C. He holds a Bachelor of Architecture from Texas Tech University, and has twenty-two years of documentation experience with Heritage Documentation Programs. While still a fan of hand drafting, Dana emphasizes digital documentation of engineering and industrial sites using high-tech measuring devices such as High Definition Surveying (HDS) combined with 3D reverse-engineering software and CAD. His most recent projects and collaborations include the Statue of Liberty, Grand Canyon's Grand Gulch Copper Mine, NASA's Rocket Engine Test Stands, and Hawaii's Pu'ukohola Heiau National Historic Site.

Designing the LIDAR Mission for Industrial Heritage: Cooperation Across the Fields

Heritage managers and digital documentarians may see the same subject but observe it through a contrasting set of filters. The focus of this paper is to present an approach by which the capabilities of three-dimensional digital documentation for preservation can be adapted to complement the interests of cultural heritage management and the public it serves. The case study selected for this discussion is the Champion No. 4 Mine Shaft-Rock House located near Painesdale, in Michigan's Upper Peninsula. Management and interpretation of the Champion No. 4 is the responsibility of Painesdale Mine and Shaft Inc. (PM&S Inc.), the major stakeholder and owner of the site. Initial discussion with PM&S Inc. confirmed that the organization lacked exposure to virtual or augmented realities and had not considered other digital presentation channels including social media. The primary goal of this project is to assist PM&S Inc. in guiding a reality-based survey (e.g. laser scanning, photogrammetry, etc.) to collect data which may be formatted into digital products to educate the public and enhance their enjoyment, respect, and appreciation of the Champion Mine site. The project outlined in this paper will demonstrate the greater utility of integrating a cultural heritage management perspective with requirements of the survey to document, preserve, and manage heritage resources.

The subject used for the study is a prominent landmark locally known as the "Champion No. 4 Shaft House." The shaft house is the oldest of five surviving examples, of its type, remaining from the 1840-1968 copper mining era. PM&S Inc. provides public access to the ground floor; however, safety issues prohibit tours and interpretation of the upper regions of the structure. This paper will document the process of conducting a terrestrial LIDAR mission designed to collect interior and exterior 3D data of the shaft house and process equipment. Data collected during the mission will be archived for documentation, preservation, and future production of interpretation and presentation products.

Typically, civil engineering firms are contracted to plan and conduct laser scanning missions for heritage documentation and preservation. Generally, these firms are not connected to the mission statements or the public interpretation concerns of heritage managers who may be responsible for operation and promotion of the site being surveyed. While these engineering firms posses the equipment and expertise, they may lack awareness of how their method of data collection could impact new applications and distribution technologies being developed for the heritage sector. Heritage managers, on the other hand, may not be familiar with emerging technologies yet have the need to communicate the value and significance of their sites within the natural cultural setting and social context.

The process presented in this paper will serve as a model for engaging engineering and heritage professionals in designing comprehensive documentation and preservation experiences to positively influence appreciation of the Champion No. 4 Mine Shaft-Rock House and similar heritage sites.

Mark Dice has over thirty-five years' experience in video media production and is pursuing an M.S. in Industrial History and Archaeology degree at Michigan Technical University in Houghton, Michigan. He earned a BME in Music Education from Kansas State Teachers College in Emporia, Kansas, and launched a video production company in 1976. In 1982, Mark designed and built the first portable multi-camera production system for projecting live concerts and has participated in over 400 live events. Mark is researching ways data collected by laser scanning can be used to develop educational products for the enhancement of heritage tourism.

Timothy Goddard has fifteen years experience with geospatial technologies in archaeology and is writing a dissertation at Michigan Technological University's Ph.D. program in Industrial Heritage and Archaeology. Tim received his Bachelor's degree in Anthropology from the University of Arizona, Master's in Applied Anthropology (Historical Archaeology emphasis) and Certificate in Historic Preservation from the University of Maryland at College Park. Tim is integrating GPS/GIS, total station, remote sensing, database design, virtual reality, field data collection, and network design into the work processes of archeological, biological, and environmental safety. Tim is a second-generation archaeologist, merging spatial technology with archaeology methodology for heritage applications.

New Techniques to Animate Old Iron

For over two hundred years, the dominant methods of depicting industrial equipment and processes in print have been steel plate etchings, plans and isometric drawings, and later, airbrushed photos, renderings, and commercial photography. While digital three-dimensional rendering and animation are newer techniques than traditional technical illustration, at this point they really can't be termed "new." However, these processes, designed and optimized for use in architecture, film production, forensics, video games and many other applications are increasingly being utilized to depict the look and function of "old iron."

Three-dimensional rendering applications typically fall into one of two broad categories: solid modelers or surface modelers. Solid modeling has the capability to build and render objects as though they are made of solid material: cut one open and you see whatever "solid" material is inside, much like slicing an apple in half. Cut open an identical surface-modeled object and you see nothing: a hollow shell defined by a surrounding "skin." Solid modeling is capable of defining extremely close tolerances, making it suitable for computer-aided design (CAD) applications for manufacturing and prototyping, and depending on the software, varying amounts of surface texturing and animation. Surface modeling packages, in this case Autodesk's 3DStudio Max, generally offer precise, editable control over all facets of animation, lighting, and surface textures, where the goal is a good visual presentation and manufacturing-grade precision is not needed.

I work primarily as a traditional paint-on-board freelance illustrator. As such, I found my way into 3D digital art in the mid-1990s while illustrating a series of perspective-dependent paintings depicting portions of Manhattan from an aerial viewpoint. The ability to revise the perspective of compositions, both in conceptual sketches and finished artwork, was the reason I purchased my first computer and an initial 3D package. In the next couple of years I quickly outgrew that first computer, learned the prospective uses as well as many of the limitations, and began to explore the more powerful lighting and animation features, along with producing a few pieces of finished art digitally. I now use 3D software at least as a design layout tool for many projects.

When visually reconstructing old or non-existent mechanical and architectural subjects in any media, good reference is vital. In recent years, sources of online reference material have increased exponentially, and this applies to historical industrial subjects as well. Many institutional and personal photo and plan archives, U.S. Patent drawings, and Sanborn maps are now at the artist's fingertips online, and no longer require a trip to the local library. That said, nothing replaces an actual visit to extant historic sites, and any online research is strictly limited to what's been digitized so far. Even so, many accurate visual keys to the past have never been easier to locate. Improvements in scanning capability and graphics software for individual usage have opened new avenues for utilizing this data to produce accurate 3D models. If an engineering drawing, plan, blueprint, or map can be scanned or otherwise digitized, it can very easily be used as the starting point to build a 3D model. Actually making objects connect and move the way they should, as well as designing how they interact with environmental and real-world physical influences, require related but different sets of procedures. Oftentimes a part or assembly's constraints or range of motion will be self-evident, but other factors like speed and influence on other components need further research to accurately portray how they function.

The next few years will be very interesting in terms of how various blends of 3D animation, presentation, and prototyping go forward. Given enough processing power and imagination, the applications seem almost endless.

John P. Maggard III is a Cincinnati-based freelance illustrator and animator, with a strong interest in all things historical and industrial, particularly the history of railroads and the steel industry. He is a member and past board officer of the Cincinnati Railroad Club, a non-profit archival and historical society since 1937, and has done recent animation and promotional work with the Tod Engine Foundation of Youngstown, Ohio, and the Chestnut Hill Museum in Boston. John earned a BFA from Miami University in Oxford, Ohio, in 1976, and serves on the Terrace Park Ohio Volunteer EMS and Fire Departments as Chief and Captain, respectively. A member of the New York Society of Illustrators and Graphic Arts Guild, he has been represented by Scott Hull Artists Representative since 1980. Current and past illustration clients include Mead Paper Company, the National Football League, Lionel Corporation, American Heart Association, Disney, Time-Life Music, Hayward Baker, *Atlantic Monthly,* and Anheuser-Busch.

(Geo)Social Media and the SIA

From hit movies to multi-billion dollar Initial Public Offerings (IPOs), social media are constantly in the news. This presentation is about what SIA has been doing in this space, with a view as to what's worked, and what hasn't. There is an emphasis on how other organizations in which our members are involved can use social media to attract, engage and enlist members. There have been experimental SIA efforts on Facebook and other social networks for several years (really!). These started with just a few followers, but have grown into a diverse community on several networks. For example, there is a Storify.com collection of shared images, posts, tweets, and added narrative of our last Annual Conference in Seattle, which was shared in an eNews. New tools emerge constantly, such as the geosocial network on FourSquare. The talk will look at how SIA is using these tools to reach current and potential new friends, and how other organizations can make use of this tidal wave to get folks involved with the things they care about.

There may be a tendency to dismiss this phenomenon as transient or unimportant, "after all, I don't use Facebook…." Well, over 850 million other people do, and we and like-minded organizations and friends ignore this sector at our long-term peril.

Jay McCauley is, for the moment, President of SIA. He has been an internal activist for the use of new media to reach out to members and friends for several years. He created experimental LinkedIn, Facebook, and other social media presences for the SIA, and has helped develop these into active communities. Lately he has been helping with the California Preservation Foundation Annual Conference in Oakland, California, including the use of #CAPresConf as a hashtag, and the creation of a FourSquare.com list of venues and destinations that allow conference attendees to check in at locations and find friends nearby. Jay's mantra has been "using new stuff to get folks to look at old stuff." Follow him on Facebook or @jaym3 on twitter.com; he'll be tweeting the conference. His and others' shared images, tweets, and blog posts will be a new Storify story.