# CRM

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Cultural Resources Management Information for Parks, Federal Agencies, Indian Tribes, States, Local Governments and the Private Sector

U.S. Department of the Interior
National Park Service
Cultural Resources

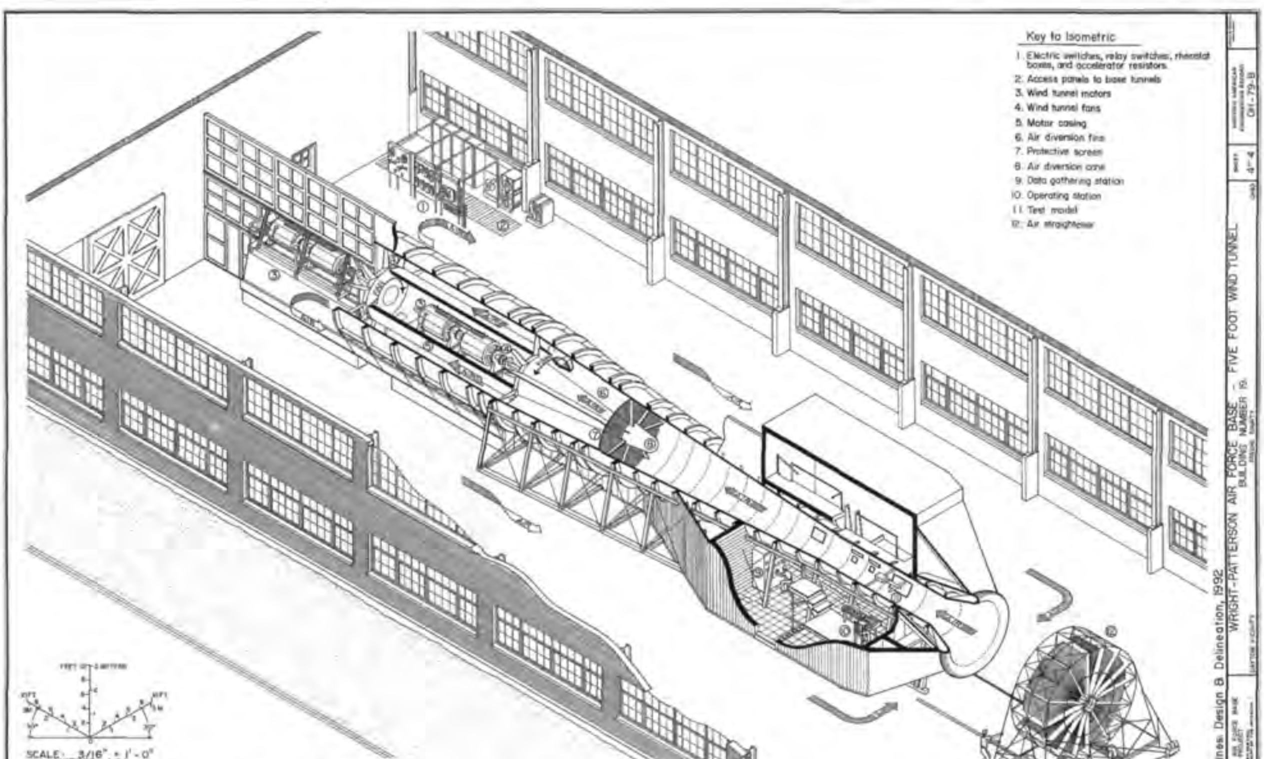

# HABS/HAER—Moving Forward with the Past


John A. Burns


The Historic American Buildings Survey/Historic American Engineering Record (HABS/HAER) Division of the National Park Service is a unique Federal program whose responsibility is to document America's architectural, engineering and industrial heritage. HABS, the older of the two, was founded in 1933, making it the oldest Federal program dealing with the preservation of the built environment. The establishment of the HAER program in 1969 recognized the distinctions between architectural and engineering documentation. Prior to that time, HABS had recorded engineering and industrial sites along with its better-known efforts to record buildings. The genesis of HABS was the high unemployment rate among architects during the Great Depression coupled with concern and alarm over the continuing rapid disappearance of buildings representing the Nation's cultural patrimony. Linked with the emphasis on threatened buildings was the complementary need for documentation for the proper care and maintenance of unthreatened historic buildings. Indeed, one of the early sets of HABS drawings was for the Moore House at Yorktown, the first structure for which the National Park Service produced a historic structure report.

HABS was created administratively under a tripartite agreement among the Library of Congress, the American Institute of Architects, and the National Park Service. Legislative authority came with the passage of the Historic Sites Act two years later. With that authority came


*(**Moving**—continued on page 7)*


**Isometric of Five Foot Wind Tunnel, Area B, Wright-Patterson Air Force Base, Ohio. Delineated by Hardlines: Design & Delineation, 1992. (See article, page 16.)**

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# Recording NPS Roads and Bridges

**Todd Croteau**


**Original Bureau of Public Roads *construction reports* provide HAER researchers with details of the building process from excavation to completion and offer pictorial evidence of construction technologies and labor practices. Construction of Deer Creek Bridge in Mount Rainier National Park, 1939.**

HAER is now in its fifth year of a long-range documentation project for the National Park Service Roads and Bridges Program. The Roads and Bridges Recording Project is committed to the collection and creation of data pertaining to all National Register eligible historic bridge structures maintained by the National Park Service (NPS). Over the past several years more attention has turned to the idea of including the actual roads and road-related cultural landscapes as research topics. HAER is exploring new facets of the built environment by including not only the structures, but also the transportation system as a whole in relation to the natural environment. There is a history of construction in the national parks that reflects the concept of harmonizing the built with the natural through the use of native material and designs that grow from the landscape. Examples of this philosophy are most noticeable in the architecture of park buildings; however, the extensive engineering works of the park road systems integrate so well that they are often unseen by visitors partaking of the wondrous vistas. In many ways, the roads are probably the most successfully integrated structures in the landscape.

> *In any area in which the preservation of the beauty of Nature is a primary purpose, every modification of the natural landscape, whether it be by the construction of a road or erection of a shelter, is an intrusion. A basic objective...is to hold these intrusions to a minimum and so design them that, besides being attractive to look upon, they appear to belong to and be a part of their settings.*
>
> *—Arno B. Cammerer, Director of the National Park Service, 1935*

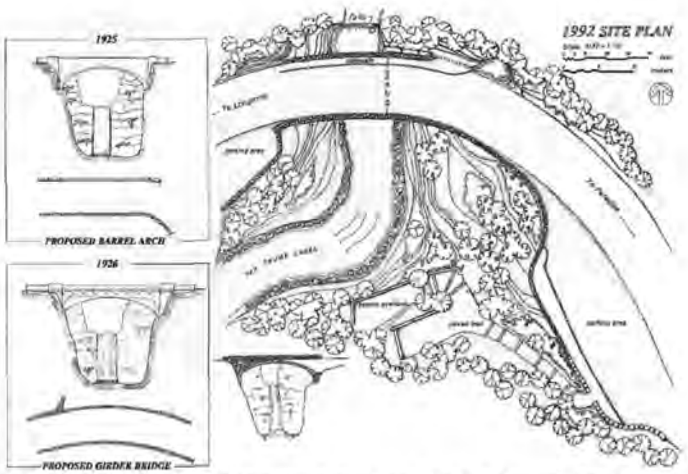
**Continued visitor increases are placing greater demands on park infrastructure and many road-related resources will require replacement. Contemporary HAER photos are contrasted with historic images to illustrate a structure's evolution. Stoneman Bridge, built in 1932, spans the Merced River in Yosemite National Park. Photo by Bryan Grogan, 1991, HAER.**

Many of these roads were designed more than 100 years ago and their builders were unaware of the traffic demands occurring today. In recent years park roads have experienced increased visitation and a rise in the number of oversized vehicles, requiring inadequate roads to be upgraded and the crumbling infrastructure of the national park system to be rebuilt. Many historically significant transportation structures are threatened by replacement or alterations that may weaken the integrity of the original appearance. Although some of these bridges and tunnels are beyond their carrying capacity and require replacement, HAER hopes to preserve-on-paper the intrinsic qualities of the structures that have become a symbol of the NPS commitment to "lay lightly on the land."

HAER is documenting four major eras of design and construction in the national park system—early market-driven access, Army Corps of Engineers, National Park

***(Roads and Bridges**—continued on page 4)*


**Construction detail of Stoneman Bridge, 1932, illustrates the process of bridge building in the national parks. Delineated by David Fleming, 1991, HAER.**



This plan and elevation of Christine Falls Bridge, built at Mount Rainier National Park in 1928, illustrates the evolution of NPS designs. Several proposals for concrete structures, each with different attitudes toward the landscape, result in a bridge that appears to grow from the land and integrate into its setting. The use of native stone facing and curved roadways harmonizes the built with the natural. Delineated by Daniela Trettel, 1992, HAER.

*(**Roads and Bridges**—continued from page 3)*

Service, and Bureau of Public Roads. In many cases, the first access to these new preserves was achieved by entrepreneurs hoping to find their wealth in mining or tourism. Pack trails and rough roads were built using hand labor. Since the first national parks were administered by the military until the creation of the NPS in 1916, the U.S. Army Corps of Engineers was responsible for all road and bridge construction in the preserves. The Corps created transportation networks that showcased the scenic wonders of a park while maintaining a sensitivity to the natural landscape.

A small collection of Army Corps structures exists in the NPS today and their road systems still retain most of the original character. Implementation and maintenance of roads in the national parks was transferred to the newly formed NPS in 1916. Almost immediately, the Secretary of the Interior, Franklin Lane, reaffirmed the Army Corps' philosophy toward road construction. In his Statement of National Park Policy, he addressed road construction specifically by calling for the harmonizing of roads, trails, buildings and other improvements with the landscape, and the employment of "trained engineers who either possess the knowledge of landscape architecture or have a proper appreciation of the aesthetic value of park lands." In 1926, the NPS and the Bureau of Public Roads (BPR, U.S. Department of Agriculture) reached an agreement that the BPR would take responsibility for upgrading and constructing new roads in the national park system. Park landscape architects worked with BPR engineers to create new structures that continued to harmonize with the natural settings, while allowing safe passage of the modern automobile. The BPR continued construction in the national parks through the 1950s under several different titles. Today the Federal Highway Administration of the Department of Transportation oversees road and bridge building in the national parks.

Like most HAER programs, the NPS Roads and Bridges Documentation Project will generate written historical narratives, ink-on-Mylar measured drawings and large-format black and white photographs of significant structures. An added component to the archival documentation is the design of an illustrated brochure that depicts the road and bridge building history of each national park. The brochure is produced by the project and delivered to the parks for distribution. The negatives of the publication are also given to the parks for future reprinting and continued distribution to visitors.

The NPS Roads and Bridges Recording Project began with documentation of the National Capital Region structures in Washington, DC, and has since moved to the great western parks. Surveys of Yellowstone National Park's loop road, Glacier National Park's Going-to-the-Sun Road, Yosemite National Park and Mount Rainier National Park have been developed to date. Future projects include the parks along the Colorado River valley and Acadia National Park.

HAER's National Park Service Roads and Bridges Recording Project hopes to identify the structures that are most representative of the NPS rustic style and develop detailed surveys that will interpret the sites for future generations—not only for visitors, but also for those charged with maintaining existing spans and designing the new structures of our Nation's most precious preserves. Parks are faced with the realities of cost-effectiveness, the issues of safety and the need for speed, but must consider the aesthetics.

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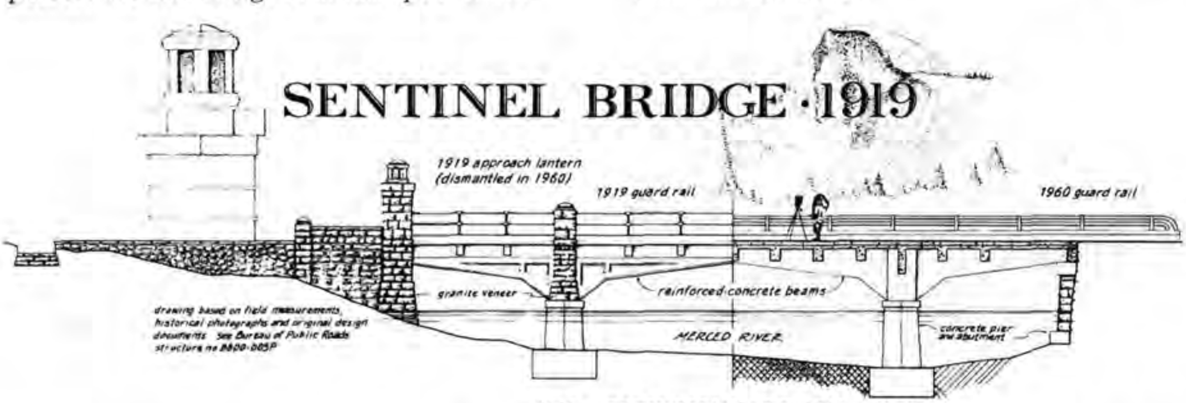
Todd Croteau is an architect with the HAER Branch of the National Park Service.



Over the life span of many park bridges, alterations occur to the structures that change their appearance or function. HAER develops illustrations that interpret these changes from past to present using historical photographs, original drawings and written reports found in park archives. Yosemite National Park's Sentinel Bridge has seen dramatic alterations and is now scheduled for replacement. Delineated by Marie-Claude LeSauteur, 1991, HAER.

# Documenting Rock Creek and Potomac Parkway

Sara Amy Leach

Documentation of historic landscapes, especially "natural" ones, is a challenge that encompasses bridges and buildings, vegetation and vistas. The embodiment of such a complex site is the parkway or park road, which caught the attention of HABS/HAER after several years of recording landscapes and bridges as separate entities. In the case of Rock Creek and Potomac Parkway in Washington, DC, which was documented over the summers of 1991 and 1992, the project as a whole falls under the aegis of HABS, which assessed the overall landscape and two adjacent service stations; ten vehicular and pedestrian bridges are cataloged as HAER sites. Study of this 2.5-mile corridor was designed as a pilot project, aimed at developing documentation standards, with the sponsorship of the Park Roads and Bridges Program of the Engineering and Safety Services Division, National Park Service.

The team members who worked on the project reflect the multifaceted nature of the site, and undertaking historic research as the first step proved essential. During summer 1991, a landscape architect and a historian conducted background research, preparing much of the overall history and ascertaining the availability of hundreds of historic drawings and photographs. As a conclusion to this initial investigation, draft in-house guidelines for documenting a parkway or park road were compiled, using graphics from the Rock Creek and Potomac Parkway. This past summer, five architects and landscape architects, and a historian were added to the original historian and landscape architect to form a larger team.

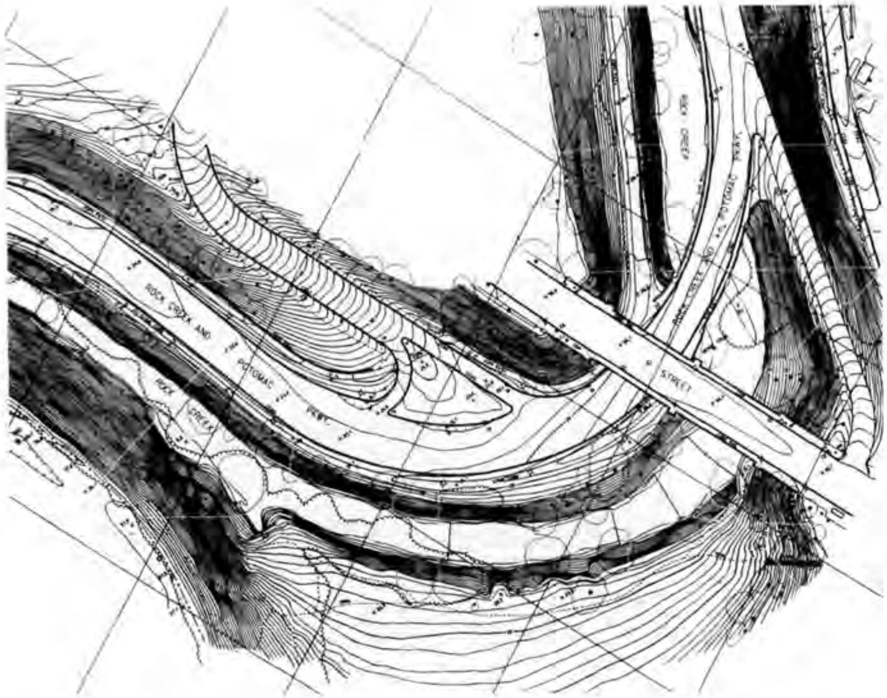
The Rock Creek and Potomac Parkway project was sponsored by the Park Roads and Bridges Program of the National Park Service, John Gingles, deputy chief, Engineering and Safety Services Division. The project supervisor was Sara Amy Leach, HABS historian. The Washington-based summer 1992 documentation team was headed by landscape architect Robert Harvey (Iowa State University-Department of Landscape Architecture) who served as field supervisor; the landscape architects were Deborah Warshaw (University of Virginia) and Dorota Pape-Siliwonczuk (US/ICOMOS-Poland, Board of Historical Palaces and Gardens Restoration); the architects were Evan Miller (University of Colorado-Boulder), Steven Nose (University of Maryland), and Tony Arcaro (Catholic University). The historians were Tim Davis (University of Texas) and Amy Ross (University of Virginia). Jack E. Boucher made the large-format photographs, thanks to the U.S. Park Police-Aviation Division; Air Survey Corporation of Sterling, VA, produced the aerial photography and digital mapping from which the site-plan delineations were made. In summer 1991, Davis and Warshaw were the investigators, and Will Rieley, principal of Rieley Associates of Charlottesville, VA, served as a consultant.

**Aerial perspective-corrected photograph of area south of P Street to Waterside Drive. Air Survey Corporation, 1992.**

Rock Creek and Potomac Parkway was authorized in 1913 to enable the reclamation and conservation of the polluted Rock Creek, which had served as a dumping ground for nearby industries and tenement dwellers. In keeping with the function of a parkway, it was designed to link two major parks—the National Zoological Park at the north terminus and the Potomac River parks on the south. Today it is the oldest thread of a larger, metropolitan tapestry of five major parkways and several minor border or strip roads. Noteworthy for the graceful path it makes along the creek, into the cavernous valley where Rock Creek Park begins, by 1937 this scenic drive was also considered a critical commuter artery where local one-way traffic patterns were introduced.

Rock Creek and Potomac Parkway was selected as the model for HABS/HAER's study because of its uncontested historic significance, integrity, size, and proximity to the HABS/HAER Washington office; the work was timed to conclude before park officials initiated rehabilitation, which is slated to begin in 1996. The cost of the first year of the project was $28,000; the second year cost slightly more than $100,000, approximately 25% of which was spent on the aerial photography and digitization.

*(**Parkway**—continued on page 6)*

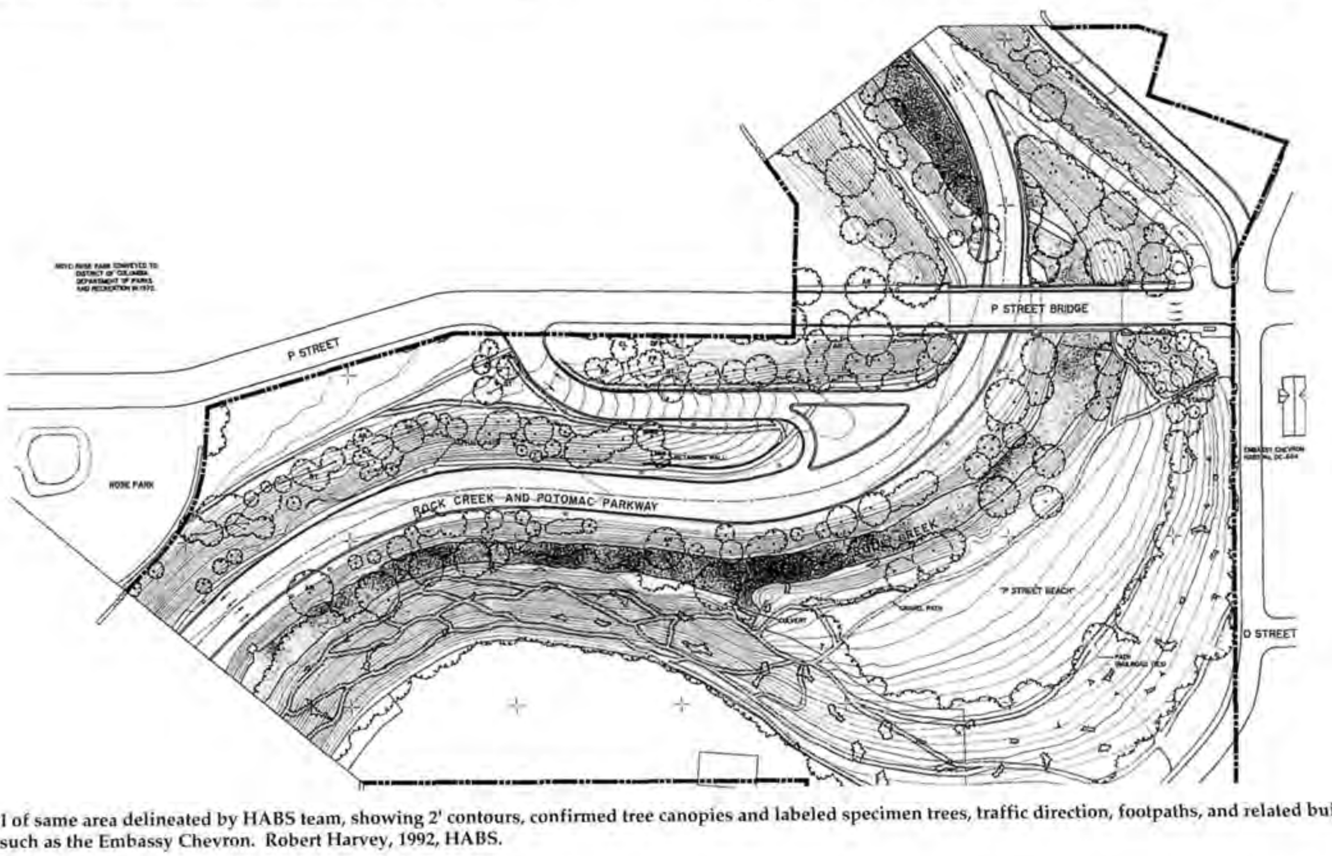


Detail of area as digitally mapped, showing 1' contours, tree bases, and probable canopies. Air Survey Corporation, 1992.

*(**Parkway**—continued from page 5)*

The foremost documentation decision was to contract for aerial photogrammetric photographs of the parkway as the basis for digitized mapping and interpretive drawings. There were no comprehensive contemporary plans showing land patterns, much less at the scale of the original drawings, of which many exist. The flyover in Washington's much-restricted airspace was made just prior to the leaves budding out on the trees so the bold topography is fully exposed, but as late as possible to gain as high and bright a sunlight as possible. More than a dozen 9" x 9" color contact prints were made. The plan and its features were generated at 1"=40'—the same as the 1920s-30s plans—a generous scale that dictated an average flying elevation of 1,800'. The breadth of the survey swath was set at 100' on either side of the parkway or the creek, whichever was farthest, though the parkway's legal right-of-way is much wider. In retrospect this was insufficient, since the termini of the bridges are usually beyond this edge, as are some interesting details and vistas; subsequent field visits fleshed out these areas. HABS/HAER requested the depiction of 1' contours, tree canopy with trunk placement for specimen species, bridges with spot heights and saddles, and the road and creek themselves. It took several weeks between photography and completion of the mapping on 24" x 36" Mylar sheets; to facilitate Federal Highway Administration (FHWA) work in the future, the base digitization was backed up on computer tape, which will go to the National Capital Region along with copies of other products upon completion of the project.

HABS chose to trace and enhance its rendition of the site plan on its new E-size Mylar that measures 34" x 44"; because of the twists and turns the parkway makes, it would have been awkward to accommodate on the




Detail of same area delineated by HABS team, showing 2' contours, confirmed tree canopies and labeled specimen trees, traffic direction, footpaths, and related buildings, such as the Embassy Chevron. Robert Harvey, 1992, HABS.

smaller size. Fourteen sheets make up the distance from the Lincoln Memorial to the zoo-tunnel headwall, and three versions were generated: the hard features such as roads, bridges, and buildings, and 2' contour lines; the plantings, showing tree canopy, labeled specimen trees with trunk placement; and a photographically combined set of overlays. Alignment of the overlays was achieved using pin-bar registration. Though labor-intensive tasks such as stippling innumerable contour lines and determining boundaries were tedious, techniques such as airbrushing the extensive stream and waterfront area was innovative, fast, and provided a consistency of texture.

In addition to the plans and a key sheet, the architects and landscape architects generated two sheets of historic plans and proposals, two sheets of bridge elevations, and one sheet of landscape sections. The historic plans show the contrasting closed-valley (to contain the creek and fill the void) and open-valley options (as seen today) posed in 1908, followed by the gradual elimination of parkway features, shown in plans of 1916, 1924, and 1933. Nine bridges are drawn at 1"=20' scale, assembled as "poster" sheets. They were not measured because they are under the jurisdiction of the District of Columbia, and funding would have had to come from outside the Park Service. The side-by-side elevations succeed in visualizing the sequence of what appears before the motorist's eyes, from the cluttered area by the mouth of the creek where the simple, low-slung arches are faced with ashlar, to the more elaborate and monumental masonry crossings at the deepest point of the valley.

The historians researched the parkway to its fullest, all the way driving the scope of drawings. A sizable report covers the parkway's chronology from its foundations in the City Beautiful Movement and the early history of Washington, DC, through design options, legislation, acquisition of land, construction, and alterations to it after completion in 1936. The context of related structures is dealt with here, as well as in the form of individual HABS and HAER histories. All the bridges—vehicular and pedestrian—crossing and carrying the parkway are cataloged, as are two privately owned service stations. Though by definition parkways are devoid of commercial buildings, automobile service stations were a necessary evil made tolerable by sympathetic styling, usually rustic or Colonial Revival. Locally, the Shipstead-Luce Act of 1930 required that the design of structures adjacent to Federal park land be reviewed by the Commission of Fine Arts. The two examples along the Rock Creek and Potomac Parkway are a contrast unto themselves—a dark, gabled rustic block with slate roof, and a clean Neoclassical limestone cross plan. Erected on the fringe streets convenient to the parkway, such buildings are integral to studying the motor age while sympathetic to the parkway setting. Higgins Service Station on Virginia Avenue is, in fact, one of the few instances of commercial rustic styling in the city, and indicative of what the Park Service might have built for itself. The historian chronicled the importance of these in terms of designers, engineers, and their role in serving vehicular traffic in the area.

Large-format photography is used to its fullest potential, combining contemporary views with historic images. HABS photographer Jack E. Boucher made aerial views from 500'-1,000', as well as from the pedestrian level, which include details of ornament and construction. Whenever possible, "now" views are taken of constructions, vistas, and sites for which "then" pictures are available.

In retrospect, the documentation of Rock Creek and Potomac Parkway was a productive documentation and pilot project. A comprehensive assemblage of drawings, photographs, and written history more than adequately serves the needs of FHWA and NPS officials, while introducing a new kind of site to the HABS/HAER collection—one served by both engineering and architectural sides of the HABS/HAER Division.

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Sara Amy Leach is an architectural historian with HABS, National Park Service. She has led projects investigating the New Jersey Coastal Heritage Trail, the L'Enfant-McMillan Plan of Washington, DC, and the Rock Creek and Potomac Parkway, and has a particular interest in the relationship between the automobile and the landscape.

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*(**Moving**—continued from page 1)*

a unique provision that allowed HABS and, subsequently, HAER to seek and use outside resources to conduct their mandated work. That provision has been the basis for hundreds of cooperative projects undertaken with parks, other Federal, state and local agencies, private organizations, and even individuals.

Increasingly over the past decade, HABS and HAER documentation projects have been driven by stewardship needs. Cultural resource managers use benchmark documentation as the basis for maintenance decisions, for assessing conditions, for planning appropriate treatments, and for public information and interpretation. Stewardship is thus a common thread among recent recording projects. Given the huge number of historic structures in the United States, the need for adequate documentation is clearly enormous but unfortunately the resources to accomplish that work are clearly limited. For that reason, HABS/HAER is developing new techniques and technologies to address that need within the realities of time and fiscal constraints. Several of the articles in this issue of *CRM* highlight recent work with photogrammetry and computer-aided-drafting, or CAD. Another evolution in the two programs derives from the ever-broadening definition of what constitutes the historic built environment. HABS, for instance, is recording the design of highways in the landscape. HAER is studying a major industry, steel, simultaneously in several regions of the country; as well as rapidly evolving, and therefore ephemeral, technologies such as the development of military aviation. The articles which follow were compiled to represent these and other current methodologies, practices, and technologies used in HABS and HAER documentation projects.

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John A. Burns, A.I.A., is the deputy chief, HABS/HAER Division. He coordinated this issue of *CRM* and served as guest editor.

# Measuring Buildings for CAD Measured Drawings

## The Lincoln and Jefferson Memorials

Mark Schara

Since June 1991, HABS has been working on a project, in conjunction with the National Capital Region (NCR) and the Denver Service Center (DSC), to document the Lincoln and Jefferson Memorials in order to produce a "record set" of drawings of the two buildings. These drawings, detailing the existing conditions of the two structures, are to be used as the base drawings for the upcoming restoration of these important buildings.

At an early stage in the development of the project it was determined that, instead of producing traditional HABS ink-on-Mylar drawings, all drawings were to be done on computer, using computer-aided drafting (CAD) techniques. The software chosen was AutoCAD Release 11, the National Park Service (NPS) standard. Although HABS has used CAD on a limited basis in the past (most notably to record the Texas State Capitol), this will be the first HABS project resulting in a complete and extensive set of measured drawings (plans, elevations, sections, details) on CAD. As such, our goals for this project have included developing HABS standards for CAD drawings, as well as developing a methodology for measuring buildings for CAD drawings.

Our experience to date has confirmed numerous advantages for CAD drawings when compared to traditional drawings done by hand. One advantage is that it allows us to work on very large drawings. The main level plan of the Jefferson Memorial, if drawn by hand at a scale of 1/8" = 1'-0", would require a sheet at least five-foot-square, an extremely awkward size with which to work. Drawing with CAD, however, allows the user to "zoom" in and out of the image, and thus work on only a small part of the drawing at one time, and at any scale desired. This situation is analogous to a word-processing program, where, at any given time, the user sees and works on only part of one page of a much longer document. And because the CAD image is essentially drawn at full scale, it allows us to contain in a single drawing all of the detail which would typically be drawn on several different sheets at several different scales in a hand-drawn set. Another advantage involves the ability to replicate discreet items with simple "copy" or "array" commands, again, similar to the "copy" command of a word-processing program. Thus, at the Jefferson Memorial it was necessary to actually draw only one exterior column in plan, and then copy it to produce the other 37. In a hand drawing, all 38 columns would have had to be drawn individually. Yet another advantage involves the ability to draw different items in different "layers," which can subsequently be turned on and off. This allows the user to manipulate both the visual and the plotted images, in terms of what is shown and not shown. Thus, for example, in the plan drawing of the Lincoln Memorial the walls, the door and window openings, the floor joints, the molding edges, and the stairs are each drawn in a separate layer, and any combination of these items can be plotted simply by turning on or off the appropriate layers. Finally, a major advantage of CAD drawings is their ability to be plotted at any scale desired, by means of a simple change in one of the plot command parameters. This dispenses with the necessity of either redrawing by hand or of using photographic reproduction when a drawing at a different scale is needed.

For the Denver Service Center, supervisors of the restoration project, and the National Capital Region, in charge of maintenance of the two buildings, having CAD drawing files of the Lincoln and Jefferson Memorials will prove to be invaluable. A significant advantage of magnetic media is the ease with which it can be copied and dispersed, and already both the DSC and several of its architectural and engineering contractors are using copies of the HABS CAD files as the base drawings for their restoration work. In addition, AutoCAD allows written data to be entered and keyed into specific entities in its CAD files. For example, specific information from various surveys as well as records of maintenance can be entered and listed directly in the appropriate drawing. For the NCR, the CAD files will provide a useful database that can be easily updated when changes are made to the buildings, rather than using drawings which will have to be laboriously redrawn to remain current.

Traditional HABS drawings are drawn in ink on Mylar, at a pre-determined scale. And in fact, one final result of this project is to be a complete set of 1/8" = 1'-0" scale drawings plotted on Mylar and then deposited at the Library of Congress. As noted above, however, CAD

**HABS architect Mark Schara (left) and HAER photographer Jet Lowe are captured in an image taken by the photogrammetric camera mounted at the end of a photo boom at the top of the Lincoln Memorial scaffolding. The empty frame provides four coordinates of known separation, used to provide scale and orientation during the digitizing process. The resulting drawing is shown at right.**

Photo by Jet Lowe, 1992, HABS/HAER.

drawings are essentially drawn at full scale and then plotted at whatever scale is desired. The need to measure these buildings in order to accommodate full-scale drawing accuracy has remained a challenge throughout the course of the project. Whereas a 1/2" discrepancy would be indiscernibly small on a 1/8" or 1/4" scale drawing, it remains 1/2" on a full-scale CAD drawing. In addition, the AutoCAD software allows an incredible accuracy in drawing, to 1/64" in English units or to eight decimal points of an inch in decimal units. This accuracy is well beyond our ability to achieve in measuring (as, in fact, it is well beyond the ability of the construction industry to achieve in building).

Thus it became apparent to us at the beginning of this project that a great deal of accuracy would be required in our measurements, more so than for a traditional HABS project. We decided to measure to the nearest 1/8" (this was the smallest division on some of our measuring tapes) for most aspects of our drawings, and to the nearest 1/16" for certain details (such as moldings). This need for accuracy was compounded by the enormous size of these two buildings, allowing for the greater potential for discrepancies and inhibiting our abilities to take long strings of dimensions because of sag in the tapes. We soon abandoned the use of cloth (fiberglass) measuring tapes for most situations because of their tendency to stretch when pulled over long distances. We determined metal tapes to be more dimensionally stable, if occasionally less flexible.

There have been other challenges associated with measuring these buildings. As both buildings are to remain open to the public during their restoration, we have had to work around the large number of daily visitors each receives. The sizes of the buildings precluded their being completely wrapped in scaffolding, because of the expense. Instead, four moveable scaffolding towers were erected at the Lincoln Memorial and two at the Jefferson Memorial, each spanning one bay. Our dimensioning in the areas accessed by the towers had to be incremental, rather than using the continuous strings favored by HABS for accuracy. It also had to be timely and complete, as the towers only occupied any given position once. While the scaffolding towers provided us with invaluable access to the building surfaces for measuring (as well as providing access for various survey teams and future restoration work), they were too close to the building for the photogrammetric photography which we were undertaking. This problem was solved by the use of several 11'-long custom-built booms, designed by DSC in conjunction with HABS, which were mounted to the scaffolding. By mounting our camera on the end of the boom, swinging it out into space, and positioning it so that it faced back toward the building, we were able to get the images we needed from the appropriate distances.

As noted, photogrammetry has been an integral part of this project. We are using two Linhof Metrika cameras, unique in the United States, in conjunction with PhotoCAD, a photogrammetric software which works as an add-on to AutoCAD. This software allows us to digitize photogrammetric images, producing AutoCAD drawing files. We have used the two-dimensional version of PhotoCAD extensively, documenting, for example, the carved ornament at the entablature and the attic parapet of the Lincoln Memorial as well as the Ionic capitals of the Jefferson Memorial. Typically, this kind of detail would by extremely difficult, if not virtually impossible, to measure and draw by hand, especially at the level of accuracy we are obtaining with photogrammetry. The three-dimensional version of PhotoCAD has proven useful in the basement of the Lincoln Memorial, where the use of scaffolding was determined to be prohibitively expensive. It has enabled us to document the structural framing at the underside of the slab, 40' above grade, by the use of photogrammetric images taken from below. (A more extensive description of this photogrammetric process can be found in the article, "Charleston Photogrammetry," elsewhere in this issue.)

As with all new technologies, our use of CAD-photogrammetry has not been trouble-free. In addition to the usual learning curve, there have been simple problems concerning access and lighting, as well as occasional mechanical glitches with our equipment. More problematic, we have discovered that the resulting drawing files tend to be extremely large because of the amount of detail contained, thus taxing both AutoCAD's capabilities as well as the memory available in our computer system. In fact, at a point approximately two-thirds of the way through the project, we have had to significantly upgrade our computer system in order to handle these drawing files. Nonetheless, as we work toward resolving these issues, it seems apparent that both CAD and CAD-photogrammetry will become increasingly more useful, and thus increasingly used, as tools to document our Nation's historic resources.

Lincoln Memorial cornice. Delineated by Jose Raul Vazquez, Mellonee Rheams, Dana Lockett, and Mark Schara, 1992, HABS/HAER.

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Mark Schara, an architect with HABS, is supervisor of the Lincoln and Jefferson Memorials documentation project. He has previous work experience with HABS in Alaska and in Washington, DC, as well as in the private sector.

# White House Documentation Projects

Frederick J. Lindstrom

Few people realize that the White House is designated Washington, D.C.'s Park Reservation No. 1. However, only the grounds and exterior walls of the house carry that designation. The central residential portion of the house is under the auspices of the independent, non-political Executive Residence, managed by the Chief Usher Gary Walters and his staff. The East and West Wings are managed by the General Services Administration. In 1988, the White House, in cooperation with the Office of White House

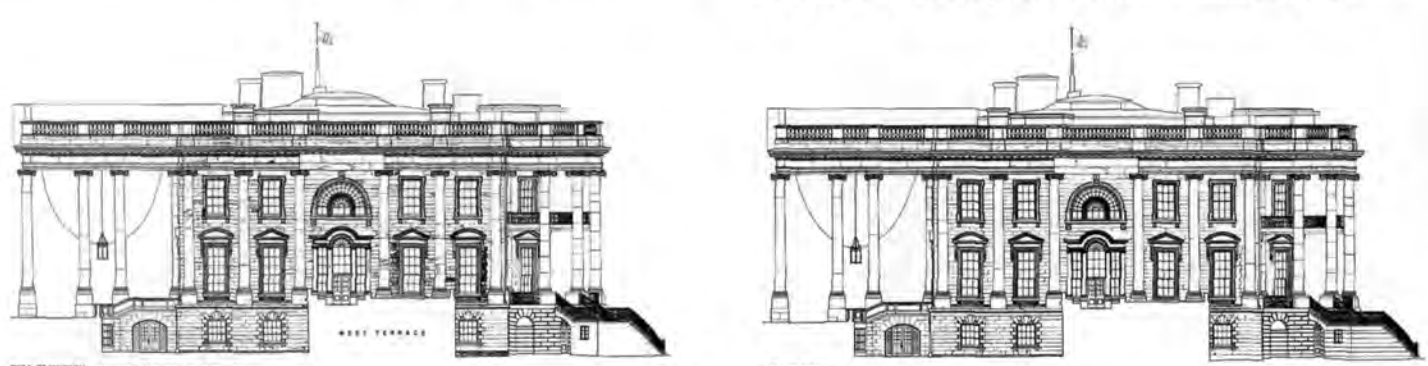
North elevation of the White House being repainted. Photo by Jack E. Boucher, 1989, HABS.

Liaison of the National Capital Region of the National Park Service (NPS) and HABS, began a five-year documentation program to record the exterior elevations of the original central portion of the residence. This documentation project was to be a component of a larger restoration effort that had begun earlier to clean, repair and repaint the exterior walls. In early 1990, the American Institute of Architects in cooperation with the White House Historical Association sponsored HABS to record the interior architecture of the White House to celebrate, on October 13, 1992, the 200th anniversary of the laying of the cornerstone. This project was to be a complement to the ongoing exterior documentation program and was scheduled to run continuously, until October of 1992, so that the drawings of both projects would be completed by the 200th anniversary.

South porch of the White House with the scaffolding of the stone masons. Photo by Jack E. Boucher, 1991, HABS.

The exterior documentation was initially established during the summer months of 1988, 1989, and 1990 with small teams of four architectural technicians and an architect supervisor working intensely for 12 weeks. As 32 different paint layers were removed and the Aquia sandstone facing repaired, HABS began to systematically record the exterior of the structure. This was a first time opportunity to document the stone exterior. The house, historically, has always been painted except for the first few years after its construction when the masonry and mortar were allowed to dry, and for a similar period after the reconstruction following its burning during the War of 1812.

The summer teams hand measured the previously obscured carved detail and mortar joints. Each stone was measured and overall dimensions of the facades were taken in order to generate existing condition scaled drawings of all four elevations with variations removing the north and south porches to reveal the back walls.



Final HABS sheet of the 1/8" scale reductions of the west elevation with and without the stone graining. All of the elevations were drawn originally at 1/4" to maintain a high level of detail and will appear in the final set in both 1/4" and 1/8" scales. Drawn by Douglas Anderson, Isabel Chia-Ya Yang, Timothy A. Buehner, and Eric Schmidt, 1990-92, HABS.

Using prints of the photogrammetric plates produced by Dennett, Muessig, Ryan and Associates in 1984 and 1990 and HABS staff photographer Jack E. Boucher's 5" x 7" large-format, black and white images of the bare Aquia sandstone facing, the teams rendered copies of the base drawings of the elevations with the stone graining as it was revealed. The drawings and photographs of the bare walls are the only record of what the house looks like unpainted. Larger scale drawings of details such as the exquisite stone carving on the north entry doorway, the second-floor fan windows, the two different cornice profiles, and the iron lanterns of the south entrance were produced. Details representing each of the typical window configurations were also generated. These drawings are examples of precision technical delineation.

Photograph of the north entry door, stripped of the 32 coats of paint that had occluded the stone carving. Photo by Jack E. Boucher, 1989, HABS.

Detail drawing of the north entry door of the White House. Delineated by Richard A. Ventrone, Jr., Timothy A. Buehner, Ronald M. Bailey, Scot C. McBroom, Paul G. Homeyer, and Douglas Anderson, 1989-92, HABS.

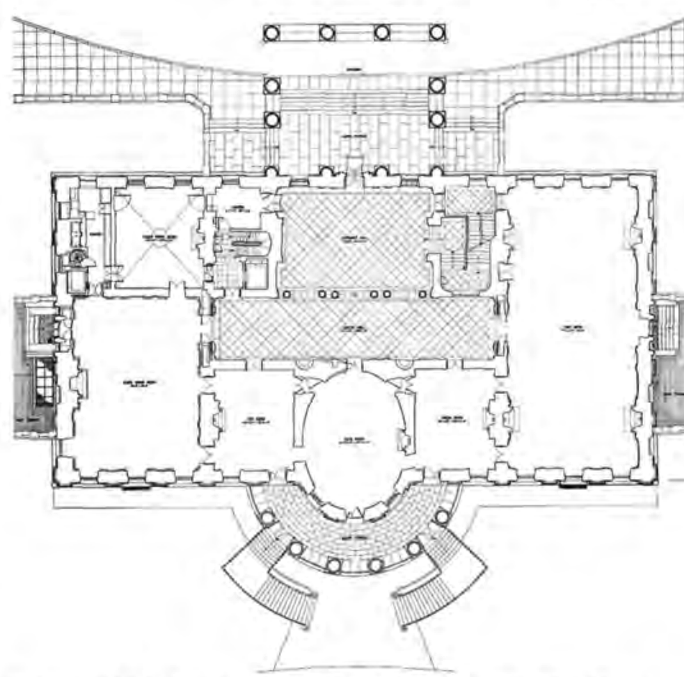
With the assistance and guidance of the White House Office of the Curator and the White House Usher's Office, the HABS White House Interiors Documentation Project was begun in June of 1990. Prior to the start of on-site work, an analysis and planning document was produced, listing by room every wall, closet, molding, and architectural element. Each feature that was to be drawn or photographed was listed and then annotated with descriptive comments citing the date when it was placed in the house and identifying the moldings as "typicals" when they were commonly found in other rooms. Also, every feature was labeled to indicate in which final drawing it would appear. As the schedules of the President, First Lady, and the Residence are highly dynamic, this document became a critical part of organizing and tracking each day's field work. Often the team would start work in a room and because of scheduled or unscheduled events in the Residence, they would be required to relocate to another part of the house. Sometimes they would not return to that room to resume measuring for days, weeks, or in some cases, months. Working closely with Chief Usher Walters, the team was allowed, with the exception of a few intervals, to be continuously on site sketching and measuring the interior architectural features for approximately 15 months.

The White House interiors team at work measuring the ceiling of the east room of the White House. Photo by Frederick J. Lindstrom, 1991, HABS.

During this period, the comprehensive photographic record of the interiors was also initiated. The photography had to be scheduled as closely and as carefully as the measuring. Routinely, both would be underway simultaneously, but in different rooms, complicating the scheduling problems. Whenever the HABS architects or photographer was in the house, there was always an escort, who was either a member of the house staff, or more often a uniformed Secret Service officer. The team, with their escort, had to move throughout the house as a group. This required additional time allowances for moving within and around the house, as did the necessity to clear a security check each time the team entered the grounds. If it had not been for the diligence and flexibility of the ushers, the field work would not have progressed as smoothly and efficiently as it did.

The on-site recording was done with traditional hand-measuring techniques, sketching, annotating, and using

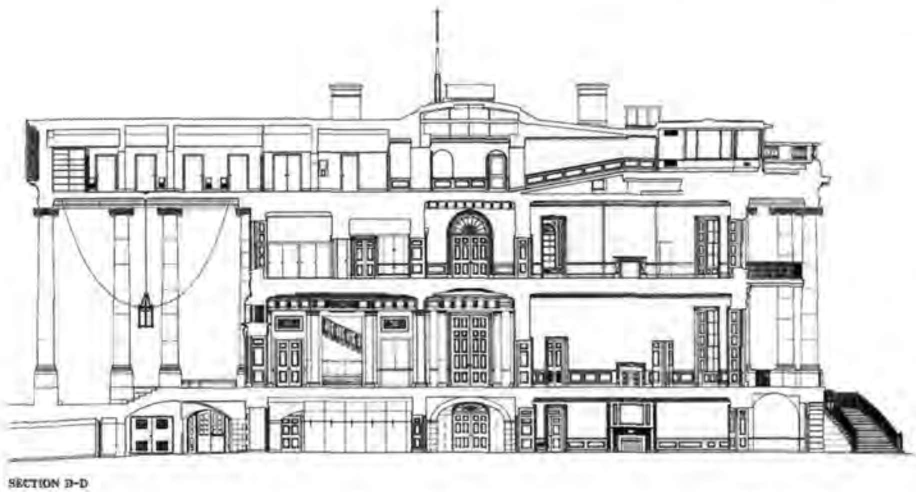
*(White House—continued on page 12)*



Final ink on Mylar line drawing of the first (State) floor of the White House. Delineated by Gillian B. Lewis, Kenneth W. Martin, and Scot C. McBroom; preliminary by Gillian B. Lewis, 1990-92, HABS.

*(**White House**—continued from page 11)*

basic tools for taking dimensions such as measuring tapes, rulers, levels, and plumb lines. A Lietz telescoping Digital Reading Measure Pole was used for ceiling heights, reducing the use of bulky ladders. These methods are labor and time intensive but are highly accurate. The team had to carefully work around the furniture and art objects. Whenever a piece of furniture was blocking access to a detail or a lamp was in the way of extending a measuring tape across a room, the team would have to stop and request the house staff to move the individual piece. This was done only when necessary and many times alternative strategies were invoked to measure around furniture, crystal chandeliers and art work. All dimensions were taken to the nearest 1/8", with some of the more intricate details measured to the closest 1/32". All large-scale details were carefully drawn in the field notes at full scale to eliminate any errors in scale translations.




**Transverse Building Section of the White House. Delineated by Douglas Anderson, 1990-92, HABS.**

After the first months of on-site field work, the teams started to develop the preliminary pencil drawings. This initially was done whenever they were not scheduled to be at the house. As the projects progressed and the bulk of the field work was completed, the teams concentrated on laying out the preliminary drawings. Once the preliminaries were set, the teams would then over-lay them with Mylar and redraw in ink, rendering what was called a process drawing. The different exterior teams had limited goals for each summer so as to allow them the experience of each step in creating a HABS measured drawing. The results of the interior and exterior projects were combined in the last stage of producing HABS measured drawings. The final step was to reproduce the drawings into HABS standard sheet formats. This was done using line negatives with a direct photographic reproduction method to transfer the process drawings to HABS Mylar. Included in this stage was the addition of notations, dimensions, titles, and other graphic symbols to complete the final drawings.

With the 2 projects combined, a total of 31 team members generated approximately 850 pages of field notes, 42 preliminary ink-on-film process drawings, 88 sheets of final inked HABS sheets, and approximately 2,200 35mm field photographs. More than 700 large format black and white, and color photographs were produced recording all the rooms inside the residence, the exterior elevations, and the grounds.

In February of 1992, the American Institute of Architects (AIA) and the American Architectural Foundation in cooperation with The White House Historical Association organized an exhibit of historical drawings and photographs of the White House. This exhibition, "The White House 1792-1992: Image in Architecture," opened at the Octagon in Washington, DC and brought together for the first time many previously unseen drawings of the house. HABS had the privilege to display an assortment of the original project materials in the lobby of the AIA building. Following this exhibition in June, The AIA Press published William Seale's *The White House, The History of an American Idea*. Throughout the book many photographs and drawings from the documentation projects have been used for illustrations, with most of the drawings concentrated in the chapters dealing with contemporary history.

The last step in the project will be transmitting the documentation to the Library of Congress.[1] Before the set is sent to the Library, each photograph and negative will be individually identified, numbered, labeled and indexed, as will the drawings and the rest of the field materials. The final set of documentation drawings and photo-graphs will have a 500-year service life and will be placed in the HABS/HAER collection in the Library of Congress' Prints and Photographs Division in early 1993.

There are more than 22,000 identified sheets of drawings of the White House.[2] Of those drawings, HABS will have produced the only comprehensive set of documents accurately recording the historic main house as it stands today. These drawings and photographs will be used as baseline documents for future renovation, restoration, maintenance and interpretation of the President's House.

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1 Approximately one-third of the documentation will be transmitted to the Library of Congress.

2 The White House Architectural Drawing Project, David Krause project supervisor, has identified and cataloged more than 22,000 sheets of architectural, structural, mechanical, and historical drawings pertaining to the White House. This project is supported by the National Capital Region-White House Liaison and the Executive Support Facility. The HABS documentation drawings, field notes, preliminary and final ink drawings, have been included in this database.

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Frederick J. Lindstrom is a HABS architect and the project supervisor for the White House Documentation Projects. Lindstrom's work with HABS started in 1987 documenting the Virginia Governor's Mansion in Richmond. He has also supervised the recording projects at the Virginia State Capitol Building, and the Cape Hatteras Light House.

# The Jeannette Glass Study

Gray Fitzsimons

From its inception in the 1930s, HABS has produced hundreds of architectural drawings and numerous manuscripts on architectural history. Much of this work has been largely descriptive: the structural features and architectural ornaments were discussed in the histories and delineated in the drawings, the builder or architect was identified, and major alterations to the buildings were noted. With the formation of HAER in the late 1960s, this same approach to history was adopted. The emphasis remained primarily on the descriptive; engineering and industrial works were thoroughly described and a great deal of attention was focused on inventors, engineers, or industrialists. In recent years HABS/HAER has attempted to push its work beyond the simply descriptive and has begun to examine the material fabric in a larger social and cultural context. One such study carried out in 1990-91 reflects these concerns as well as an evolving methodology for carrying out HABS/HAER documentation.

Initiated after a comprehensive inventory of historic industrial sites was completed in southwestern Pennsylvania in 1989[1] the HABS/HAER documentation of the glass industry in Jeannette, PA, examines the technology of window glass production there, along with the glass workers and managers, and the community in which they lived. A group of Pittsburgh glass makers, led by James Chambers and H. Sellers McKee, established Jeannette in 1889. Located about 30 miles east of Pittsburgh, the city and glass works were built on the gently rolling hills flanking Brush Creek. Chambers and McKee chose this site because of its proximity to natural gas fields and because the main line of the Pennsylvania railroad extended through this section of Westmoreland County. Their enterprise and those of other glass manufacturers were developed and expanded throughout the late 19th and early 20th centuries.

**Columbe Hotel. Built in Jeannette ca. 1892. Visitors and glass workers rented rooms on the upper floors. The first floor contained a restaurant and tavern. In the 1930s the Flint glass workers union of the AFL occupied part of the first floor. Photo by Jet Lowe, 1988, HAER.**

By 1910 Jeannette was one of the largest window glass producers in the United States. Although bottles and tableware were also produced in Jeannette, the HABS/HAER study focuses largely on the window glass industry. It examines the window-making process and changes in factory production—from one requiring traditional artisan skills of melting, blowing, shaping, and finishing the glass, to one which mechanized the blowing process, and finally to one which adopted the Fourcault machine which largely mechanized the drawing, shaping, and finishing of the glass. These changes occurred roughly over a 30-year period, years which saw Jeannette's population grow from nearly 4,000 residents in 1900 to about 15,000 persons in 1930. The city's largest producer, the


**Lubbers Cylinder Process for making window glass, developed in the early 1900s by John Lubbers of Jeannette, PA. Delineated by Sharon Krankel and Sanford Garner, 1992, HAER.**

(*Glass—continued on page 31*)

# Charleston Photogrammetry

**Mellonee Rheams**
**Tom Behrens**

On September 23, 1989, the residents of Charleston, SC, were faced with the aftermath of Hurricane Hugo. The damage to buildings as a result of Hugo was severe. None of the historic structures around the Battery was totally destroyed, as was the case with other structures in the city. However, if a building had been lost, those without adequate documentation could not have been accurately reconstructed. Although the recovery from the storm is now almost complete, many believe that there is much more work to be done. Connie Wyrick, the director of programs and development of the Historic Charleston Foundation, defines total recovery from Hurricane Hugo as "adequate preparation for a similar occurrence." In order to be adequately prepared, the members of the Historic Charleston Foundation believed that baseline documentation was necessary for the buildings that were most susceptible to catastrophic loss. HABS has been operating by the principle of "preservation through documentation" since its inception in 1933. Given the needs of the Historic Charleston Foundation and the services that HABS and HAER provide, a natural partnership was formed.

HABS, in cooperation with the Historic Charleston Foundation, undertook a documentation project of the Battery. The project was initiated in the summer of 1992 to produce a photogrammetric and photographic record of the streetscapes along the South and East Battery in Charleston. These homes are considered the most vulnerable of the city's historic resources. This documentation is intended to provide a baseline documentation for catastrophic replacement.

Photogrammetric documentation was chosen because it is the most cost effective way of rapidly collecting data for a large number of structures, enabling the recording team to photographically document 26 houses in 8 days, working an average of 8 to 10 hours per day. The photographic images will be archived until scaled drawings are needed, at which time the graphic information can be digitized into CAD drawings using AutoCAD and PhotoCAD software and a digitizing table.

The photogrammetric camera system consists of the Linhof Metrika 45 with two lenses, a 90mm and a 150mm. It is a specialized camera that was manufactured in Germany and is the first of its kind to be used in the United States. The 90mm lens is a wide angle; the 150mm, a normal focal length. Because of the project requirements, only the 90mm lens was used for the Charleston photogrammetry project. The Metrika is a semimetric camera that produces 4"x 5" negatives on 5" roll film. A glass plate with a reseau grid (a pattern of cross hairs) is pressed against the film by a vacuum at the moment of exposure so that the grid is superimposed on the negative. The optical characteristics of the lenses and reseau grids are measured and entered into the program data so that the optical distortions in the camera do not compromise the accuracy of measurements taken from the photographs.

The digitizing software used by HABS is


**No. 34 South Battery, Charleston, SC. The photos illustrated give an example of the two different types of houses photographed 1) #34 South Battery represents a simple facade with a minimum amount of foliage compared to 2) #29 East Battery which was complex and foliage was a major factor that had to be considered when photographing. Please note the reseau grid (a pattern of cross hairs) superimposed on the photo image, the black and white Xerox targets placed randomly on the structure, and the different camera stations used. Photo by Jet Lowe, 1992, HABS.**

No. 29 East Battery, Charleston, SC. Photo by Jet Lowe, 1992, HABS.

The modus operandi for field work was to establish two datum points at a known horizontal distance and place random targets on the remainder of the house or in the field of view as common reference points to aid in the digitizing process. The datum points that were placed on each facade had to be carefully measured, as this was the most critical component within our survey control data. The survey control data (field notes), used as reference information, includes datum point locations, measurements, and different camera stations. One of the initial challenges that we were presented with was accessibility to the structures to place targets that were necessary for the digitizing phase of the photogrammetric process. The targets were placed either by the use of a ladder when safely accessible or by entering the houses to place targets on balconies and windows. Although placing the targets was a relatively simple process, access to the structures presented some scheduling problems, as many of the homeowners, for various reasons, were unavailable and we were unable to proceed with photographing their homes. However, throughout the eight days most accessibility problems were resolved without causing much delay.

published by Desktop Photogrammetry and is used in conjunction with our AutoCAD Release 11 software package. It is important to note that there are two photogrammetry programs published by Desktop Photogrammetry, PhotoCAD-Single and PhotoCAD-Multi. PhotoCAD-Multi is used for three-dimensional measurements and was, therefore, used to aid in the Charleston Photogrammetry project. Four main components are critical to the process and must be considered: (1) camera specifications such as camera calibrated focal length; (2) known horizontal node points and a dimension which must be visible in all of the photographic shots; (3) a minimum of three camera stations, usually left of center, center, and right of center; and (4) the angle of view between the camera stations must be greater than 10 degrees in order for the program to orient the images properly. The software takes at least one known dimension which must be visible in common among all photographic views, in conjunction with other common points, and uses mathematical algorithm to locate the known points in three-dimensional space. Once the three-dimensional model is established and verified other points can be digitized and measured from the photographs and a CAD drawing can be produced. To establish common points, targets can be placed on the structure in random locations prior to photography which reduces the chance of inaccuracy. The targets we use are Xerox black and white targets with a bulls eye located in the center which enhances digitizing capabilities.

Although the facades can usually be photographed from a minimum of 3 camera stations, the complexity of some of the facades required that we photograph them from 4-10 stations in order to ensure adequate coverage. In photographing a structure, many natural and man-made obstacles present limitations on obtaining the clear, clean images needed for the photogrammetry process. Those obstacles, combined with the relative complexity of the architecture, dictated the number of view station points and angles needed to adequately document a facade. Foliage and automobiles were the two major obstacles with which we had to contend. In these instances it was common that the amount of angles and view points would double or triple in order to ensure adequate coverage. One of the most beneficial techniques we employed was to use a "cherry picker" to shoot aerial views of the facades, which removed most of the foliage and showed the roof and upper portion of the facades in greater detail. Sun location and the weather also dictated

(*Charleston—continued on page 32*)

# The Engineering of Flight
## Wright-Patterson Air Force Base

**Amy Slaton**

HAER is best known for its documentation of traditional historic American technology, such as factories, canals, machine shops, bridges, and railroad facilities. These sites and structures are fortunately still very much a part of the American landscape, and will continue to be documented by HAER, but as technologies that we consider more modern also begin to age, HAER is developing an increasing number of projects to record these new sites. One such project has been the documentation of aeronautical engineering facilities at Wright-Patterson Air Force Base, located near Dayton, OH.

In the summer of 1991, HAER placed a team of six architects, two historians, and a photographer on Wright-Patterson Air Force Base, to research and record the historic aeronautical engineering features of the most historic section of the base, the old Wright Field, now known as Area B. Wright Field was constructed in 1926, and was the home of the Army Air Corps' fledgling Materiel Division. Even though aeronautical engineering activities have continued on the base to the present, HAER was most interested in structures and machinery dating from the early days of aeronautical engineering, the 1920s through the 1940s. HAER was initially invited to Wright-Patterson Air Force Base by the base's Office of Environmental Management and its Historic Preservation Officer, Chris Widener. The project was sponsored by that office and the Aeronautical Systems Center of Area B. HAER was given additional funding in September of 1991 to continue its documentation of Area B through September of 1992. Throughout the project, the team has worked closely with Jan Ferguson, the base's current preservation officer. When the project is complete, HAER will have comprehensively documented the site through the production of 45 sheets of drawings, 250 photographs, 2 brochures, and a published inventory of structures and a historical overview.

Propeller Test Rig, Area B, Wright-Patterson Air Force Base, Ohio. Photo by David Diesing, 1991, HAER.

The Army established Wright Field in 1926 to accommodate its experimental aeronautical engineering activities. The many tasks associated with developing a new aircraft—the design and testing of whole airplanes, parts, and equipment ranging from flight suits to aerial cameras to bombsights—demanded specialized structures and a complex infrastructure. HAER's architects and historians examined buildings, laboratory equipment, and the organization of the site, using as a reference a historic structures inventory prepared by the base in association with the Ohio Historic Preservation Office. The HAER documentation was conducted using


Propeller Test Rig No. 1, Area B, Wright-Patterson Air Force Base, Ohio. Delineated by Charissa Y. Wang, 1991, HAER.

Army Air Corps (later the Air Force) publications (including technical drawings, annual reports, and newsletters); individual departmental histories; and trade journals in which the findings of the Materiel Division were disseminated to the public. Oral history interviews with current and former employees of the Division also helped in establishing the intentions and practices of Army aeronautical engineers.

While HAER's architects and historians recreated the original form and content of Wright Field buildings and the design of early testing facilities, other HAER historians focused on associating the physical environment with contemporary conceptions of military air power. The decision to build Wright Field accompanied expanding public confidence in aviation as a military and commercial tool. As private aircraft manufacturers proliferated in the 1920s, Congress designated funds for an experimental station in which to test the aviation products created by industry for military application. Wright Field (replacing the smaller, temporary McCook Field of 1917), provided ample laboratory space, shops, hangars, and runways, as well as sophisticated wind tunnels and propeller and engine testing facilities.

Examining the layout of the installation itself, HAER historians found that the Army's approach to engineering aircraft displayed notable consistencies over the course of the century. Post-World War II Air Force policy articulates a "systems" approach to aircraft engineering, calling for all aspects of a plane's development to be coordinated. In fact, this approach is reflected in the earliest layout of Wright Field, in which laboratories for engine, propeller, instrument, and pilot safety investigations were all built in close proximity. The Main Laboratory building of 1929, a 150,000 square foot space, was designed expressly to allow communication between different engineering specialists.

HAER historians and architects together documented the complicated testing equipment developed by the Army Air Corps. Immensely powerful propeller whirl rigs and wind tunnels (most of which are no longer intact) were used at Wright Field before and during World War II. In final form these were unlike any found

Rotor Test Stand, Area B, Wright-Patterson Air Force Base, Ohio. Photo by David Diesing, 1991, HAER.

Technical Data Building, Area B, Wright-Patterson Air Force Base, Ohio. Photo by David Diesing, 1991, HAER.

elsewhere, but part of HAER's analysis of this equipment was to determine which aspects had been borrowed from existing aeronautical technologies, and which were devised to suit the specific needs of Wright Field's projects. This analysis placed Wright Field's facilities in their historical scientific context, and also illuminated the budgetary and administrative constraints operating on Air Corps engineers at different times.

The nature of construction styles at Wright Field also reflected the conditions under which the military worked. The original buildings of Wright Field were of a very consistent appearance: almost all were red-brick structures with large expanses of metal-framed windows and low peaked roofs. During the Great Depression, the Army relied on Works Progress Administration (WPA) funding for new construction. The lavishly decorated Technical Data Building dates from this period.

World War II brought still another building style to the field. The installation grew from some 40 structures to more than 300 in the course of the war, and pressures of time and scarcity of materials and labor brought the use of poured concrete to the site. Offices, hangars, and laboratory buildings were built quickly in simple, streamlined fashion. In addition to the engineering features of Area B, the HAER teams also documented these changing architectural styles and construction technologies.

The policies and physical conditions of aeronautical engineering at Wright Field between the late 1920s and the 1950s were shaped by the American scientific and political climate. HAER's documentation of the site offers substantial data for historians of the military, architecture, engineering and the social history of the country during this period. The information gathered by HAER teams at Wright-Patterson Air Force Base will be available to the general public through the transmittal of HAER documentation to the Library of Congress, and through the publication of an inventory and two brochures.

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Amy Slaton was project historian during the summer of 1992 for HAER's Wright-Patterson Air Force Base Recording Project. She is a Ph.D. candidate in the History and Sociology of Science at the University of Pennsylvania.

# HABS Documentation in the National Parks

Joseph D. Balachowski

During the summer of 1992, HABS undertook the documentation of four diverse National Park Service sites: Melrose and the Johnson-McCallum House at Natchez National Historical Park, MS; Painted Desert Inn at Petrified Forest National Park, AZ; three houses belonging to the families of Harry S and Elizabeth V. "Bess" Wallace Truman at Harry S Truman National Historic Site, Independence, MO; and Passage Island Light and Rock Harbor Light at Isle Royale National Park, MI. Each site presented unique challenges to the recording teams.

Melrose, built in 1845 in the Greek Revival style, was the home of attorney and planter John T. Murran. The house contains many original mid-19th century furnishings. As an excellent example of the architecture of Natchez, Melrose represents the zenith of planter society in the pre-Civil War South. The 80-acre estate includes the 14,472-square-foot main house, 12 original outlying structures—including kitchen and dairy dependencies, slave quarters, and barns—and approximately 40 acres of wooded, landscaped park land and the remains of formal gardens and orchards. The National Park Service (NPS) acquired the site in October 1988.

Melrose, Natchez NHP, Natchez, MS. View of south facade. Jack E. Boucher, photographer, 1992, HABS.

The William Johnson-John McCallum Houses are part of Natchez NHP and are located in downtown Natchez. William Johnson, a free black, was a successful businessman and diarist in antebellum Mississippi.

A team of eight architects and one historian led by Professor John P. White of Texas Tech University was charged with producing a full set of existing-condition measured drawings of the main house, the kitchen dependencies, and the Johnson McCallum House. In 12 weeks, the team drew approximately 30 sheets of plans, elevations, sections and details, following the typically intensive HABS regimen of sketching, measuring, producing preliminary pencilings on vellum, and final inkings on drafting film. The team historian researched the construction history of the Johnson-McCallum Houses, and HABS architectural photographer Jack E. Boucher shot over 75 large-format images of all the structures at both sites.

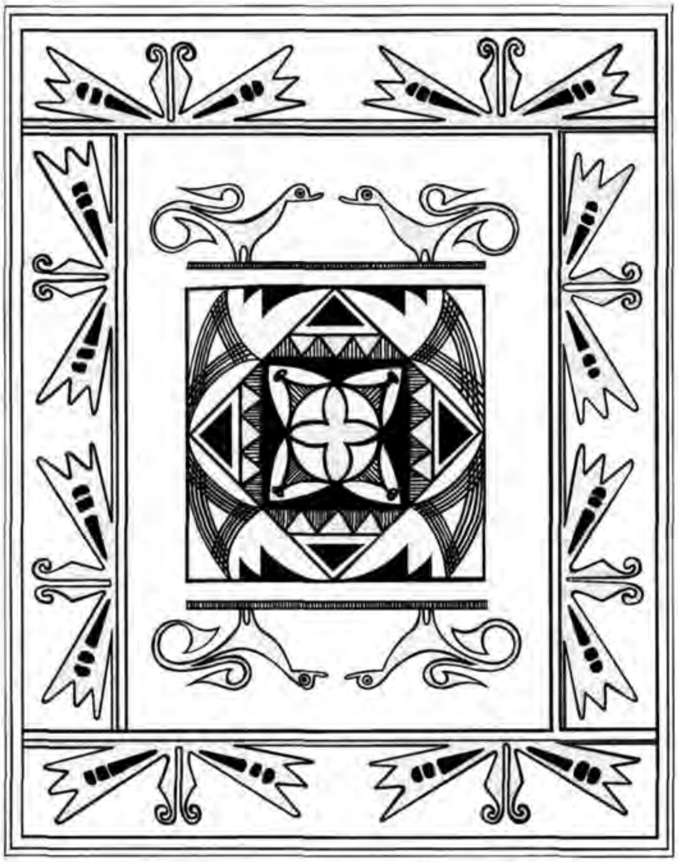
Architects who undertake the graphic documentation of historic structures occasionally have the good fortune of finding original design drawings to use as field notes, and to guide them through restoration, adaptive reuse, and other projects involving buildings' structure and fabric. The Natchez team, however, started from scratch on the Melrose buildings; field notes and pencilings of Johnson-McCallum provided by architects from the Southeast Regional Office of the NPS accelerated their progress on those structures.

In addition to working in the heat and humidity of a Mississippi summer, the team relied on their supervisor to schedule their activities around half-hourly house tours, maintenance and repair, and the necessarily high security requirements of Melrose. Because windows and doors tend to remain closed, natural ventilation of the house is curtailed, resulting in great demands on mechanical systems. The HABS drawings and photographs will enable systems engineers and maintenance workers to plan the imminent installation of a new HVAC system, and to repair or replace existing electrical, plumbing, structural and ornamental materials.

The Johnson-McCallum House drawings will aid NPS architects in stabilizing two structures that at this time rely on each other for lateral support. Urban archeological work is also reflected in the HABS documentation, and as with the Melrose drawings, will aid in future interpretation of the site.

The presence of the HABS team also added a new dimension to the cultural awareness of Natchezians, who will now view the grand architecture of their city both as monuments to the antebellum South, as well as to the ingenuity and stylistic sophistication of the builders of Natchez. The primary contacts for the project were Billy Garrett, regional historical architect, and Sarah Boykin, project architect, of the Southeast Regional Office.

The documentation of the Painted Desert Inn was initiated by Paul Cloyd, historical architect, of the Denver Service Center (DSC) and the Western Regional Office of NPS in response to several critical conditions. Heavy spring rains further damaged a badly leaking roof, and



Skylight panel, Painted Desert Inn, Petrified Forest National Park. Delineated by Patrick B. Guthrie, 1992, HABS.

exacerbated constant building shifts due to sub-surface water saturation and drainage cycles. Additionally, the Inn as constructed from 1937-40 did not successfully integrate remains of a 1920s structure of stone, petrified wood and mud mortar. When the NPS acquired Painted Desert Inn in 1936, the bentonite clays under the Inn had already been expanding and contracting for years. Finally, years of underuse and neglect of portions of the Inn motivated calls for its demolition. Visible evidence of building deterioration includes major cracks in exterior and interior walls and water damage to surface finishes, ornamentation and furniture. Numerous strain gauges installed to monitor wall movement can be found throughout the building.

While previous design and as-built drawings were available, they were incomplete and not considered accurate. A five-person team under New York architect Jorge Sein supplemented these drawings with a new set of field notes and ink-on-drafting film drawings for future rehabilitation. Western Region historian Dewey Livingston produced large-format photography and a written historical report to be incorporated into a historic structures report.

The greatest challenge to accurately recording the Painted Desert Inn lies in its "organic" pueblo revival form. Structures like the Inn—whether constructed of stone and adobe or framed with stud walls and stucco—mimic pre-Columbian constructions that used irregular, natural building materials assembled without the benefit of sophisticated surveying or measuring devices. Therefore, an extensive system of datum or control lines must be established, and some irregular features must be rendered approximately, rather than exactly.

Painted Desert Inn was designed by NPS architect Lyle E. Bennett in 1937, opened for business in 1940, but closed down for the duration of World War II. In 1946 the Fred Harvey Company took over the operation, and the following year brought their own architect, Elizabeth Jane Colter, to upgrade the building. She in turn hired Hopi artist Fred Kabotie to paint a number of murals depicting Hopi life; these murals survive to the present day. Since 1963, when Fred Harvey ceased operations there, Petrified Forest National Park has used the Inn as a museum, interpretive space and meeting hall. The Inn also appears briefly in the 1940 John Ford film, "The Grapes of Wrath."

HABS added to its collection of sites associated with presidents of the United States by documenting three homes at the Harry S Truman National Historic Site. This project was initiated by Andy Ketterson, chief of cultural resources, and Craig Kenkel, historical architect, of the Midwest Regional Office of NPS to comprehensively document all structures and sites that contribute to the cultural diversity of the region. The Frank and George Wallace Houses belonged to the family of the President's wife; the Nolan-Haukenberry House belonged to President Truman's aunt.

These properties were recently acquired by the NPS as part of an historic district adjacent to the home occupied by the Trumans during his presidency. The Wallace Houses are early-20th-century bungalows of the type found throughout the midwest and west; the Nolan-Haukenberry House is a late-19th-century Italianate Victorian. The five-person team led by Washington, DC, architect Ellen Goldkind produced a complete set of existing-condition drawings that will be used to plan the rehabilitation of the homes. Creating graphic documentation was especially critical for the Nolan-Haukenberry House because of its weakened structural and material


West elevation, Frank Wallace House, Harry S Truman National Historical Site. Delineated by Xuan-Hong Ho, 1992, HABS.

condition. The Wallace Houses—used as studio space and living quarters by the team—will eventually be upgraded for Park Service housing. Plans for the Nolan-Haukenberry House include future curatorial office space.

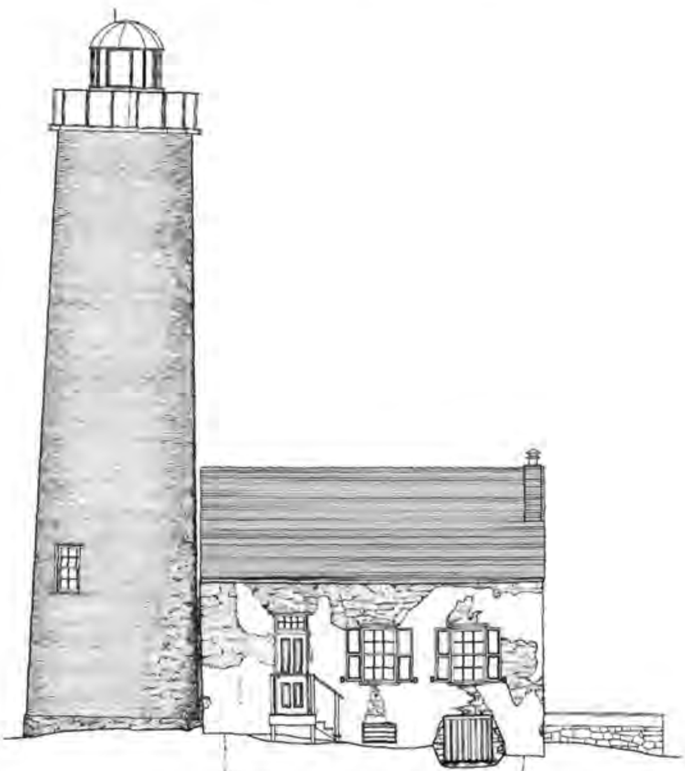
Of all recording projects undertaken by HABS/HAER this summer, the Isle Royale Lights were probably the most remote, and the most difficult to organize logistical-

*(**Parks**—continued on page 20)*

*(**Parks**—continued from page 19)*

ly. Located 50 miles north of the northern shore of Michigan's Upper Peninsula, the park is physically closer to the Canadian shore of Lake Superior, only 15 miles away. This project was also initiated by Ketterson and Kenkel.

Arrangements for housing, studio space and transportation to the two lights had to be made well in advance of the project start date, June 8. Studio space was found at a high school in Houghton, MI, location of the park's winter and mainland headquarters. The four-member team lead by Alabama architect Judith Collins set up portable drafting boards in the lighthouses to produce some of the preliminary drawings. Although an apartment housed the team for much of the 12-week project, on-site accommodations were necessarily spartan; while measuring Passage Island Light—located six miles from summer headquarters at Mott Island—the team lived and worked in the keeper's house, enduring fog, storms and sub-freezing temperatures. While measuring Rock Harbor Light, the team occupied seasonal employee dormitory space at Mott Island when it was available. The purchase and transport of food and other supplies had to be planned one to two weeks in advance.




**East elevation, Rock Harbor Lighthouse, Isle Royale National Park. Delineated by David E. Naill and Michael A. Kraeling, 1992, HABS.**

Transportation from Houghton to Isle Royale was accomplished either by boat (73 miles, 6 hours one way) or seaplane (45 minutes). Transportation among the sites was provided by Park Service personnel using smaller boats. Because Park Service personnel were often on duty at various locations, these arrangements also had to be made in advance, usually by two-way radio. The capricious weather of Lake Superior was the ultimate scheduler: high winds and dangerous waves automatically delayed or canceled trips among the islands.

There are several facets to the cultural history of Isle Royale National Park, which comprehensive HABS documentation plans to address over two to three more summers. Documentation of the lights (of which there are four) will aid in their restoration and maintenance, perhaps leading to their eventual use as interpretive sites for the lives of lightkeepers and their families, Great Lakes ore and passenger shipping, the past and present role of the Coast Guard, and the evolution of disaster prevention and rescue methods—as demonstrated by the replacement of the Fresnel lenses by solar and battery powered lights and fog signals. HABS hopes to record Edisen Fishery near Rock Harbor Light, which represents the small-scale 19th- and 20th-century commercial fishing industry; and Rock Harbor Lodge, the destination of many tourists over the last 100 years.

By using summer hires to work in the fields of architecture and architectural history, HABS affords them numerous opportunities to broaden their knowledge of these and other disciplines. The Melrose team was immersed in the culture of the South, having daily opportunities to sketch, photograph and study at close range many fine examples of Greek Revival architecture. On weekends, the vernacular architecture of rural Mississippi and Louisiana, the many high styles of Port Gibson on the Natchez Trace and New Orleans were within driving range. The Harry S Truman team was able to investigate the many fine examples of both 19th- and 20th century architecture in Kansas City, St. Louis and Chicago.

Because the study of architecture focuses on the built environment, the previous work and study experience of most HABS interns is overwhelmingly urban. By contrast, the team at Petrified Forest worked and traveled in sparsely populated northeast Arizona, a region peopled primarily by Navajo, Hopi and Apache communities. Through visits to Mesa Verde National Park, Acoma Pueblo and Santa Fe, for example, they became acquainted with the architecture of both the Anasazi and modern day Native Americans, Spanish, Mexican and "Anglo" colonists and their imitators. The Isle Royale team was exposed to what might be termed the "quintessential national park experience." Their work environment was wilderness, resulting in a constant awareness of fauna and flora, weather and terrain. They acquired an appreciation for the work of the more traditional NPS, and a greater understanding for man's response to the difficulties of working and living in a relatively harsh and unpredictable climate.

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Joseph D. Balachowski is an architect with HABS; he has field supervised and managed numerous NPS and private sector projects, and is currently rewriting the *Handbook for Recording Structures with Measured Drawings*.

# Birmingham Industrial District

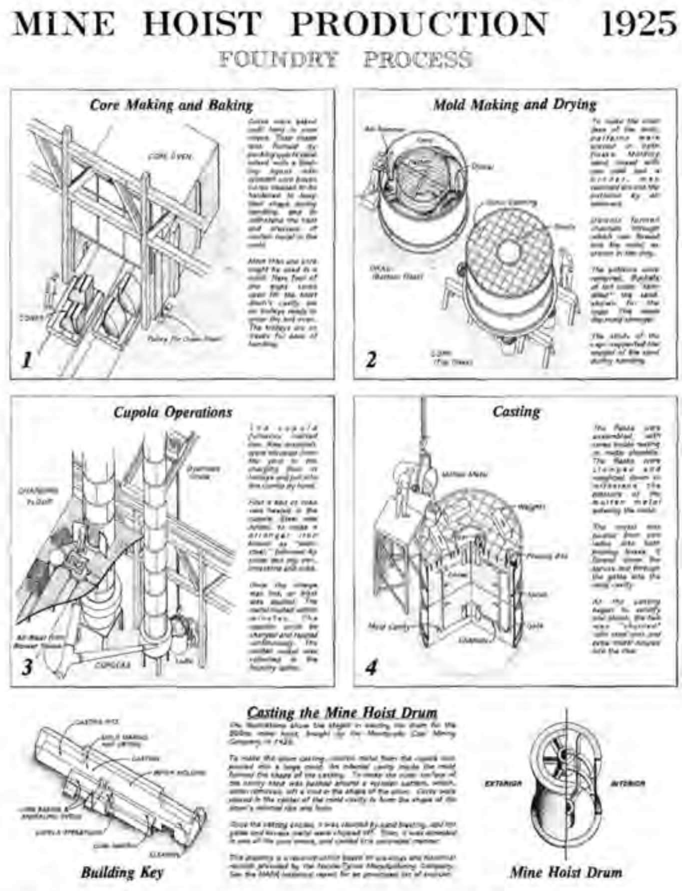
**Jack Bergstresser**

One of the largest summer recording teams ever fielded by HAER recently completed its first summer's work in the Birmingham Industrial District. The 18-member team made up of architects, architecture technicians, historians and a photographer conducted four separate recording projects in support of local efforts to establish an Industrial Heritage District in a five county area that comprised the South's largest iron and steel producer. Sponsored by the Birmingham Historical Society and funded by congressional appropriation, the team documented the railroad infrastructure of the District, the Hardie-Tynes Foundry and Machine Shop, Republic Steel Corporation's Thomas By-product Coke Works and a series of smaller, less traditional HAER sites. For the most part, the sites were selected because they tie into historical themes that distinguish the District from other important iron and steel regions.

Hardie-Tynes is a study of industrial adaptability. Having begun as a builder of steam engines, air compressors and mining equipment, Hardie-Tynes now specializes in contract work for the Defense Department, major dam projects and a variety of other customers. The company first supplied local mines and industries but later produced components for the Panama Canal, the Hoover Dam and other major national and international projects. The Hardie-Tynes team produced drawings which show how the plant changed over time in response to changing markets and a major fire that destroyed the machine shop in the 1920s. The team also produced two drawings which depict how Hardie-Tynes would have made a major piece of mining equipment. The drawings show a mine hoist drum being made, highlighting key stages in the process. They document such tasks as the melting of cast iron in a cupola and pouring it into custom made molds in the foundry. They also show selected machine tools which performed the finishing work in the machine shop.

Many pieces of equipment could have been chosen for illustration, but the mine hoist was particularly significant because it ties into the larger story of the Birmingham District. The Birmingham District is distinctive because all of the raw materials required to make pig-iron are located within very close proximity. Jones Valley, where most iron makers built their blast furnaces, is underlain by vast deposits of dolomite and limestone that are used as fluxing agents in iron smelting. On one side of the valley, within view of the furnaces, stood Red Mountain and large deposits of iron ore. On the other side of the valley lay outcrops of metallurgical coal. Not only did this fortunate geological circumstance lead to very efficient iron-making operations, it created intriguing linkages between the District's blast furnaces and local manufacturers like Hardie-Tynes, which provide exciting interpretive prospects.

The story of the mine hoist graphically illustrates this linkage. The iron ore, which eventually wound up as cast iron in the mine hoist, was mined on Red Mountain. Then it was smelted into pig-iron in one of the District's blast furnaces; quite possibly less than a mile away from Hardie-Tynes at one of the Sloss City Furnaces which are now preserved as a National Historic Landmark. After serving at a coal mine for a few years, the mine hoist was bought by Sloss and installed at its Ruffner ore mine, the archaeological ruins of which are hopefully to be preserved within the boundaries of a nature preserve on Red Mountain. There it spent the remainder of its working days hoisting more iron ore to be used to make more mine hoists.




Hardie-Tynes recording project, Laura Letton, delineator, 1992, HAER.

Obviously transportation was key to the movement of raw materials and finished products between interrelated sites in the District. In addition to recording the routes of major trunk lines and smaller industrial short lines in the District, the railroad recording project has looked at the question of vertical integration and how it might have applied in such a compact geographic area. Our research shows that Woodward Iron Company, a Wheeling, WV, transplant in the 1880s and leading local foundry pig-iron producer, had achieved full vertical integration well before Carnegie and other major northern producers. While most local blast furnace companies were not able to achieve complete company-controlled rail linkage between their holdings, what Woodward dubbed its "straight line production" model had well defined compact transportation routes. These distinct transportation routes also provide interesting

*(**Birmingham**—continued on page 22)*

(*Birmingham—continued from page 21*)

interpretive opportunities. The ore and coal mines of the Sloss City Furnaces National Historic Landmark, for example, are tied together by one such rail network, much of which is well suited for rail-to-trails type development.

The "Birmingham Industrial District c. 1950" drawing, produced by the Thomas Coke Works recording team, shows that mines and blast furnaces in the District were remarkably close together. The drawing reveals that coal which supplied the coke ovens was brought from the Sayreton coal mine less than three miles to the northeast while iron ore was brought from the Spaulding mine seven miles to the south. The Koppers byproduct coke ovens and byproduct coke plant are therefore significant not only because they provide a well-preserved example of how blast furnace fuel and its byproducts were produced but also because they can be interpreted to explain that American blast furnace companies were actually finely tuned iron-making systems in which mines, quarries coke ovens and blast furnaces worked in close harmony.

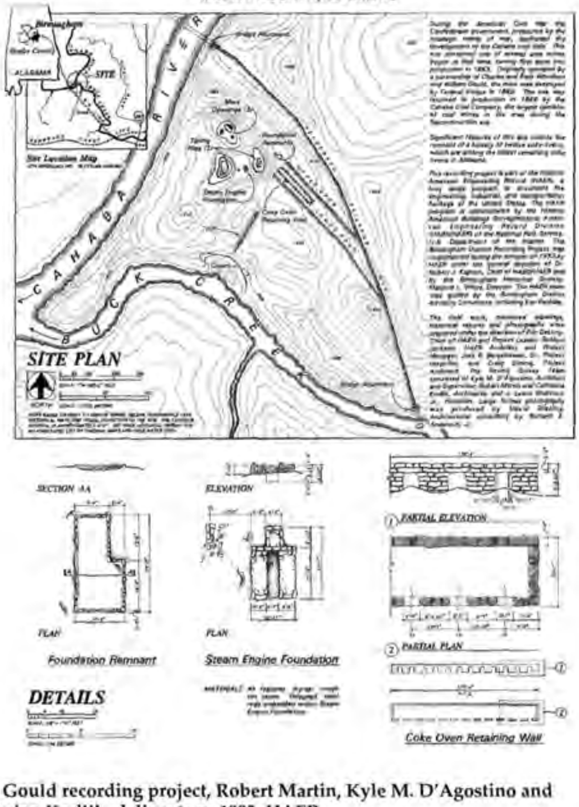
The sites documented by the roving HAER team mark not only a departure from tradition by HAER but also an innovative move to adapt its unique documentary skills to the needs of Industrial Heritage District projects. The roving team documented a series of small sites that were tied to the larger story of vertically integrated iron-making systems in the Birmingham District. Individually, none of the sites would have been substantial enough to occupy a HAER team for the whole summer but most were crucial to the long-range interpretive plans of the Industrial Heritage District. One roving team site, for instance, was the company housing of Republic Steel's Thomas blast furnace and coke works. Built in the 1880s by the family of David Thomas, who first introduced anthracite blast furnaces into the United States, the Thomas housing illustrates the living conditions of southern industrial workers and their close but distinct relationship with their northern counterparts. The team also documented the foundation remnants and other surface-viable archeological remains of two 19th century coal mine sites that mark important historical and technological episodes in the District. The Brookside coal mine reveals the pioneering role that the District played in developing American metallurgical coal washing practice. It contains perhaps the best preserved archeological remains of a Robinson-Ramsay inverted cone coal washing plant that was perfected in the Birmingham District and became the first widely used metallurgical coal washing system in the country. The "Billy Gould" mine site includes the retaining walls of an early battery of 11 non-byproduct coke ovens that date either to the Civil War or the 1870s. Both sites are tied to important blast furnaces companies: Brookside to Sloss and the "Billy Gould" mine to the experimental Eureka Furnace at Oxmoor that proved the viability of making pig-iron coke from the District's coal and iron ore. In addition to their historical significance, both are potential recreational sites, but since they are located in isolated areas and are overgrown by vegetation, it has been difficult to explain their extent and significance to planning committees and the public. The HAER drawings, photographs and historical reports of the sites eliminate this problem.

The experience of the Birmingham recording project has shown that a well-focused summer project can serve not only HAER's primary mission to record significant industrial and engineering sites but can also provide valuable support to Industrial Heritage District projects.

**BIRMINGHAM INDUSTRIAL DISTRICT c.1950**


Thomas By-Product Coking recording project, Elena Carlini, delineator, 1992, HAER.

**"BILLY GOULD"**
**COAL MINE AND COKE OVENS**
SHELBY COUNTY, ALABAMA




Billy Gould recording project, Robert Martin, Kyle M. D'Agostino and Catherine Kudlik, delineators, 1992, HAER.

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Jack Bergstresser has worked as a historian on a number of HAER projects concerning coal, milling, and hydraulic systems. His doctoral dissertation in history at Auburn University is on Alabama's coal and coke industry.

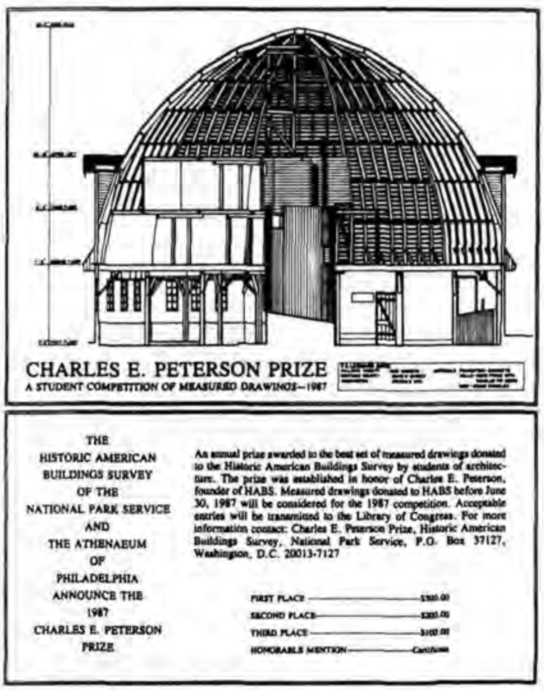
# The Charles E. Peterson Prize
## A Consistent Winner

**Caroline R. Bedinger**

Over the last 10 years, HABS and the Athenaeum of Philadelphia have sponsored a measured drawings competition for architecture students. The Charles E. Peterson Prize Competition has proven to be an extremely successful means of attracting young people to the field of historic preservation and documentation.

Named after the founder of HABS, the competition has awarded $11,000 during the past 10 competitions to the winning teams of architecture students. The competition participants must be students enrolled in a degree program. Though many are working toward their degree in architecture, others have entered the competition, including students of architectural history, landscape architecture, interior design, and American studies. In addition to being enrolled in a degree program, participants must be sponsored by a faculty member and must not be past or present employees of the HABS/HAER Division.

HABS started the Peterson Prize Competition in 1981, honoring Charles E. Peterson's 75th birthday, and awarded the first prizes in 1983, the year HABS celebrated its 50th birthday. HABS sought to educate architecture students in historic preservation and methods of documentation such as hand measuring and precise draftsmanship that were increasingly being ignored by the architecture schools. Much more emphasis is put on construction and design and as a result historic preservation and restoration are given less attention in the classroom. Few students become interested and knowledgeable in the preservation field. Furthermore, since the purpose of HABS is to record historic buildings through measured drawings and deposit the resultant documentation in the Library of Congress, the division is interested in receiving donated drawings of significant structures that have not yet been recorded to HABS standards. The stipulation in the competition rules stating that all drawings must be of a building that has not been recorded by HABS, or must make a substantial contribution to an existing set of HABS drawings, eliminates the possibility of any duplication between the work in the HABS office and the Peterson Prize submissions.




To advertise the competition posters are sent to the schools of architecture announcing the competition and the previous year's winners, in this case a round barn drawn by students at Washington State University.

The Athenaeum of Philadelphia, an independent research library founded in 1814 specializing in 19th-century social and cultural history, agreed to co-sponsor the competition with the National Park Service (NPS). A cooperative agreement was written and the program was established in 1983. The cash awards for the Peterson Prize are endowed by a privately-held fund managed by The Athenaeum.

Since 1983, over 886 students from 44 colleges and universities have participated in the Charles E. Peterson Prize Competition. They have produced 2,055 measured drawings for inclusion in the HABS collection. A great variety of types of structures have been documented by Peterson Prize competitors, from churches and plantations to sugar mills and county fairgrounds. The students have worked alone and in groups, in required courses, electives, independent study and summer institutes. Several university professors have become quite resourceful in finding funding for their documentation efforts. Some University of Texas and University of Houston students receive stipends through the Winedale Preservation Institute during their summer of recording. The State Historic Preservation Officer of Louisiana has supported four different schools of architecture in his state to enter Peterson Prize drawings. Recently the Rocky Mountain Regional Office of the NPS has helped new participants choose sites in the region that are in need of documentation to HABS standards.

The Peterson Prize Competition can be a terrific resource for cultural resource managers as long as the resulting drawings are not used as mitigation for a Federal project that will have an adverse effect on an historic structure. The jurors' rating scale encourages students to record structures of historic significance by awarding extra points if the structure is a National Historic Landmark, in a National Park, or on the National Register of Historic Places.

Each year through this program, the pool of students exposed to historic preservation grows and each year the quality of documentation they produce also increases. The Charles E. Peterson Prize Competition has increased future architects', planners', and citizens' awareness and knowledge of historic buildings throughout the United States while adding more than 2,000 measured drawings to the HABS collection. Encouraging architecture students today to recognize, respect, and record this country's historic resources will result in benefits far into the future.

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Caroline Bedinger is a historian in the HABS/HAER Division of the National Park Service.

# The Clipper Ship *Snow Squall*

## Translating a Dream Into Reality

**William A. Bayreuther**

In March 1982 two men returned to New England from the South Atlantic Ocean with a dream. Nicholas Dean and Dr. Fred Yalouris had journeyed to Port Stanley in the Falkland Islands to examine the remains of the clipper ship *Snow Squall*. Dean originally had been directed to the site three years earlier by a Falkland Islands historian; he returned with Yalouris, a Harvard archeologist, to determine the feasibility of recovering a portion of the ship's hull for conservation and exhibition on her native shore. As they photographed and took preliminary measurements of the hull, the pair decided that the clipper's intact lower bow section could be saved, although the remainder of the hull was inaccessible,

Arriving home a scant two weeks before the outbreak of the Falkland Islands War, the two men sought the means by which to undertake a series of archeological expeditions to excavate and retrieve *Snow Squall*'s available remains to South Portland, ME, the site of her construction. They assembled a team of archeologists, historians, engineers, and other adventurous individuals, obtaining the sponsorship of Harvard University's Peabody Museum of Archaeology and Ethnology and the loan or gift of the equipment and supplies necessary to begin documentation of this historic vessel.

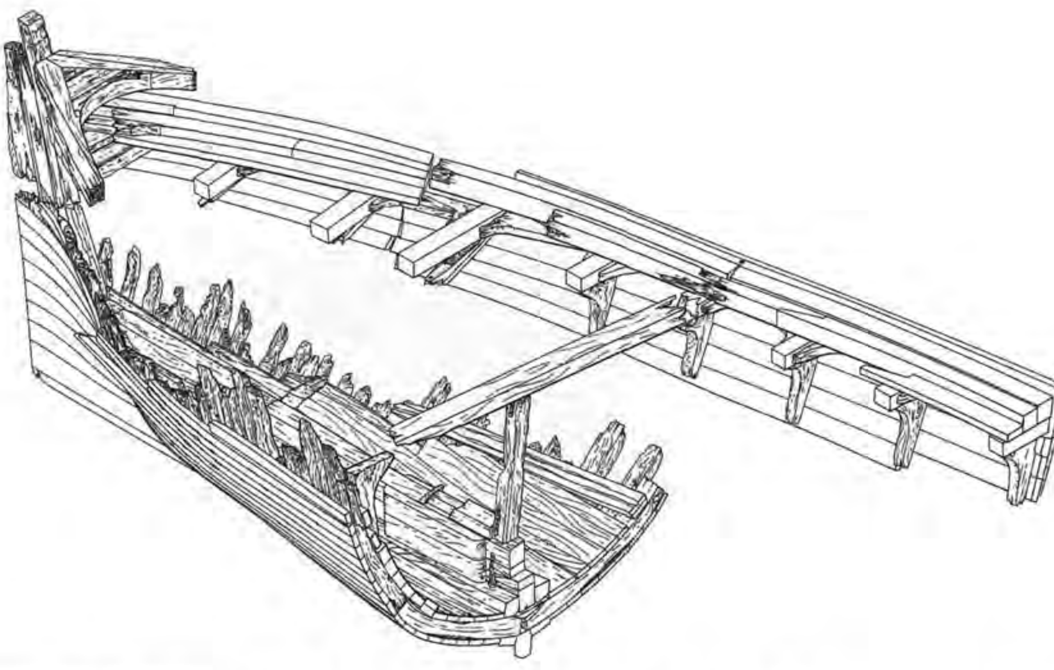
Five years and four expeditions later, the *Snow Squall* project crew brought the clipper's bow back into Portland harbor as deck cargo on the Danish freighter *Asifi*. Nick Dean had spent the month-long voyage from Port Stanley cleaning the last of the harbor mud from the hull's interior and spraying its waterlogged timbers with seawater to keep them from drying out. On March 16, 1987, a crane gently lowered the bow to its new home, the Spring Point Museum. This young local history museum assumed sponsorship of the project, accepting the challenge of translating their dream into reality—documenting, conserving, and interpreting this large 19th-century artifact.

What is the significance of this object? The clipper ship *Snow Squall* was the third of four vessels built by Cornelius Butler at his yard on Turner's Island in Cape Elizabeth (now South Portland), ME. Launched into the Fore River on July 14, 1851, for 13 years flying the house flag of New York merchant Charles R. Green in the Pacific and South American trades, *Snow Squall* carried general cargoes out and tea, spices and coffee home. On her final voyage, bound from New York to San Francisco in 1864, she ran aground in the Straits of LeMaire near Cape Horn, and was sailed in sinking condition to Port Stanley, where she was condemned and abandoned after transhipment of her cargo and sale of her gear.

*Snow Squall*'s bow *in situ* at the Falkland Islands Company Jetty in Port Stanley, 1982. Photo by Nicholas Dean.

*Snow Squall* lay as a hulk at the Falkland Islands Company jetty for over a century, damaged both by natural causes and human activity, Photographs taken ca. 1880 reveal wood stripped from her upper hull for use as building material. Storms and rot caused further damage, tons of sandstone jetty blocks shattered and smothered her midsection, and a sinking barge crushed her stern, By the mid-1980s, the only intact accessible remains of this ship comprised her bow, from the keel up to 'tweendeck level.

The four Peabody Museum expeditions accomplished preliminary documentation of *Snow Squall*'s bow and recovered all above-water structural members. The final Spring Point Museum expedition in late 1986-early 1987 retrieved the bow's 36'- long underwater section for study, treatment and interpretation at the new museum, two miles from the vessel's Turner's Island launch site.



**Axonometric drawing of *Snow Squall*'s hull shows the distinctive bow profile of a clipper ship. Delineated by Karl Bodensiek, 1992, HAER.**

*Snow Squall*'s bow survives today as the sole remaining example of the hundreds of American-built clipper ships which made record-setting voyages carrying goods and passengers to and from Gold Rush-era California, Australia, and the Far East. The clippers were very narrow in proportion to their length, with sharp, hollow bows; they were square-rigged, typically with an enormous spread of canvas. Vessels of this type developed in the 1840s, designed for speed rather than large cargo capacity in a boom time of high freight rates. By the late 1850s, economic conditions favored slower ships of greater cargo capacity and smaller crews, so clipper construction was abandoned.

The romance of the clipper ship era remains in the public mind, yet little primary evidence survives to disclose details regarding American clipper design and construction practices. *Snow Squall*'s bow section thus represents a unique resource for both scholars and the general public.

The *Snow Squall* Archeological Project has been a labor of love from its start. The entire crew which undertook the Falklands expeditions did so without pay, in time borrowed from their regular jobs. More than a hundred individuals who now work in the archeological, conservation, and education efforts under the direction of the Museum's small professional staff carry on that strong tradition of volunteer service. The *Snow Squall* project nonetheless had to wait five years for an opportunity to assemble a qualified team for a period long enough to fully document the shape and construction details of the clipper's bow.

That opportunity came with the call for applications for institutional sponsorship of the first Sally Kress Tompkins Maritime Recording Internship, named in honor of the late Deputy Chief of the Historic American Buildings Survey/Historic American Engineering Record who initiated the HAER maritime documentation program. The Council of American Maritime Museums awarded the *Snow Squall* project the intern's services, and the Council and HAER granted the museum funding for the intern's stipend.

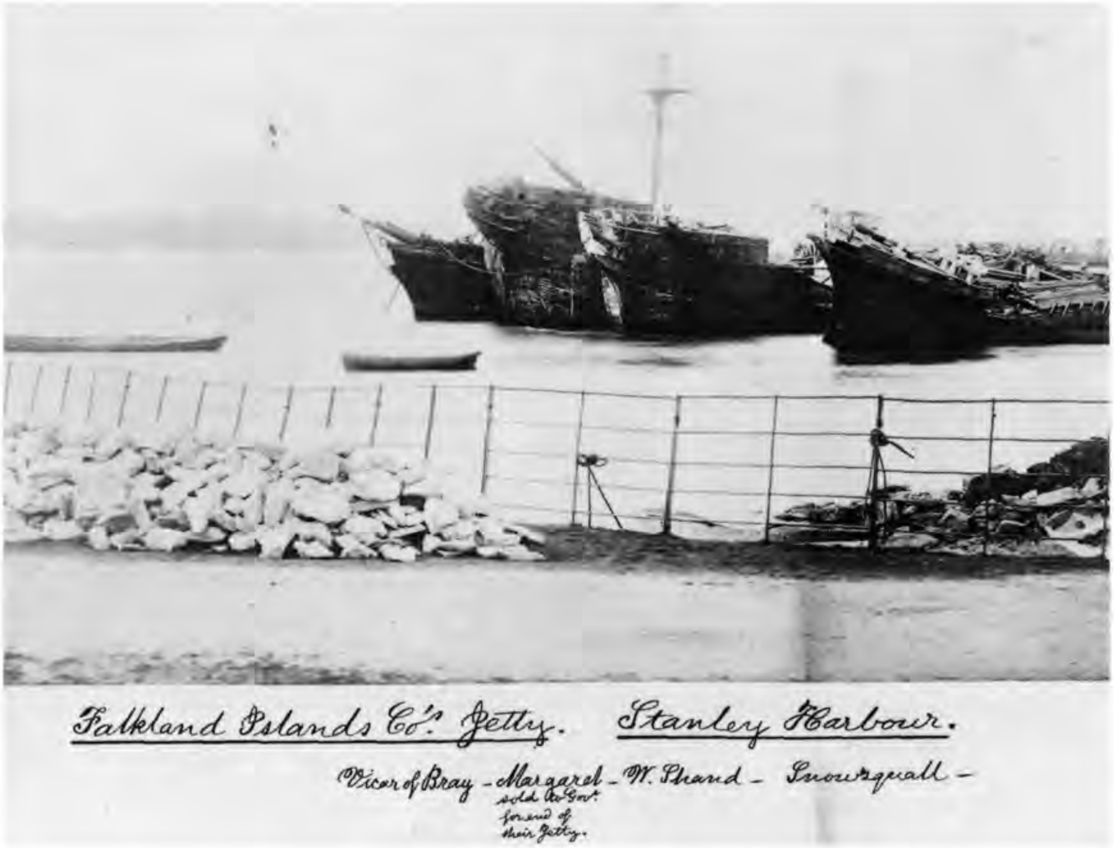
As the world's only surviving example of an American-built clipper, *Snow Squall*'s bow was of interest to HAER as an historic object which was considered a significant technological resource. HAER Maritime Project Leader Robbyn Jackson and I therefore worked out an agreement whereby HAER would provide the intern, an architect supervisor, and administrative support for a 12-week field season. On June 8, 1992, maritime intern Karl Bodensiek and architect Dale Waldron, HAER documentation project veterans, joined us for the summer.

The museum's conservator, Molly Horvath, served as liaison between the institution and the field team, providing advice and tools and locating hard-to-find ship's timbers, literally "missing links" in the documentation effort. As *Snow Squall* project historian/photographer, Nick Dean supplied the team with black-and-white prints of the bow's excavation in progress, and provided invaluable information on details of the vessel's construction. He is preparing the written historical report to augment the drawings, as well as shooting the large-format formal photographs of the hull. The final member of the team, *Snow Squall* project director Dr. David Switzer, had assumed project leadership from Fred Yalouris following the recovery of the bow; he furnished archeological expertise, and, with Nick, functioned as the project's "institutional memory."

The recording team overcame several practical difficulties in documenting the bow's intact lower section, which lies with a 26° list to port (tilt to the left side) with a downhill run of the keel as it goes aft. The team therefore adopted measurement strategies and techniques which did not require plumb and level conditions and allowed for the lack of straight lines and square corners, scarce commodities on wooden sailing vessels.

Bodensiek and Waldron, with assistance from the Museum's personnel, first "lifted the lines" of the bow, documenting the curvature of the hull's exterior at a series of stations running athwartships (perpendicular to

***(Snow Squall**—continued on page 26)*




**"Falkland Islands Co.'s Jetty, Stanley Harbor."** ***Snow Squall*** **is the vessel on the right. This photo, taken ca. 1880, shows salvaged planking piled on the clipper's deck beams, and contains the only known image of** ***Snow Squall*****'s figurehead. Courtesy J. Porter Shaw Library, San Francisco Maritime National Historical Park.**

*(**Snow Squall**—continued from page 25)*

the ship's centerline). They then developed a simple, yet highly accurate, system for recording measurements of the hull's interior area in the same planes as the stations used to measure the exterior. Despite the time-consuming process of developing measurement techniques unique to this project, Bodensiek and Waldron each finished the summer having completed five inked Mylar sheets of drawings detailing the hull's design and construction. These drawings currently are under review in Washington, prior to final inking of annotations. When finalized, they will be deposited in the HAER Collection at the Library of Congress.

***Snow Squall*** **project director David Switzer, maritime intern Karl Bodensiek, and HAER Architect Dale Waldron (from left) attach station lines to the bow section of the clipper ship in preparation for measurement of the hull's starboard side curvature. Photo by Molly Horvath, 1992.**

The Clipper Ship *Snow Squall* Bow Recording Project received major funding from the Davis Family Foundation, the Joan Whitney and Charles Shipman Payson Charitable Foundation, and the Maine State Archives' Odiorne Archeological Grant Fund. Southern Maine Technical College, on whose campus the museum lies, provided drafting tables and much-needed additional work space for the recording team.

The documentation of the design and construction of *Snow Squall*'s bow brings Nick Dean's and Fred Yalouris's 10-year dream closer to realization. The information derived from the project will facilitate the museum's ongoing conservation of the vessel, and serve as the basis for reconstruction drawings of the entire hull and the eventual reassembly of the conserved bow section. The finished drawings will prove of great interest in August of 1993, when the museum will host the Fifth Triennial Meeting of the International Council of Museums' Wet Organic Archaeological Materials Group. This will be the first meeting in the United States for this organization of over 100 conservators and scientists from 17 nations.

The museum is, at this writing, planning a capital campaign to fund the construction of a new wing to better serve the long term conservation and exhibition needs of *Snow Squall*'s bow.

Additional information on the *Snow Squall* project may be obtained by calling the Spring Point Museum at 207-799-6337.

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William A. Bayreuther is executive director of the Spring Point Museum, Southern Maine Technical College, South Portland, ME.

# The Mon Valley
## Discovering the Genesis of the Modern American Steel Industry

Joel Sabadasz

HABS/HAER, through the sponsorship of the Steel Industry Heritage Task Force (now the Steel Industry Heritage Corporation), has operated a field office in Homestead, PA since April 1989. Its primary responsibility has been to aid the task force's effort to fulfill congressionally mandated legislation regarding the establishment of a heritage preservation area in the Monongahela Valley. The character of this aid has ranged from identifying extant historically significant industrial process equipment; to helping the task force select individual industrial sites for consideration as possible heritage centers; to the preparation of in-depth documentation about each of the selected sites in the study area. [1]

The Homestead Field Office has prepared extensive documentation—histories, measured drawings, and photographs—of several of the region's steel mills, including those in Homestead, Braddock, Duquesne, and McKeesport. Among our most important findings is that the Monongahela Valley or Pittsburgh District—stretching westward to Aliquippa and southward to Monessen from Pittsburgh—was the birthplace of the modern American steel industry. The acknowledged leader in this development was Andrew Carnegie. Although bessemer steelmaking facilities had been added to several of the nation's iron mills in the late 1860s and early 1870s—most notably the Cambria Iron Works in Johnstown, PA—the major breakthrough in the relationship between steel mill design principles and the use of modern technologies did not occur until the greenfield construction of Carnegie's Edgar Thomson Works at Braddock in 1875. Designed and built under the supervision of Alexander Holley, the buildings and equipment making up the new complex promoted a continuous flow of materials through the mill. Shortly after the mill began operations, it became the largest producer of steel rails in the nation. As a result, its layout design became the prototype for the construction of integrated steel mills in the industry. Today the Edgar Thomson Works remains one of the few operating steel mills in the region.[2]

**Carrie Blast Furnaces No. 6 and 7, and Hot Blast Stoves, Swissvale, PA. Photo by Martin Stupich, 1989, HAER.**

**W. A. Young and Sons Foundry and Machine Shop, Rices Landing, PA. Photo by Jet Lowe, 1991, HAER.**

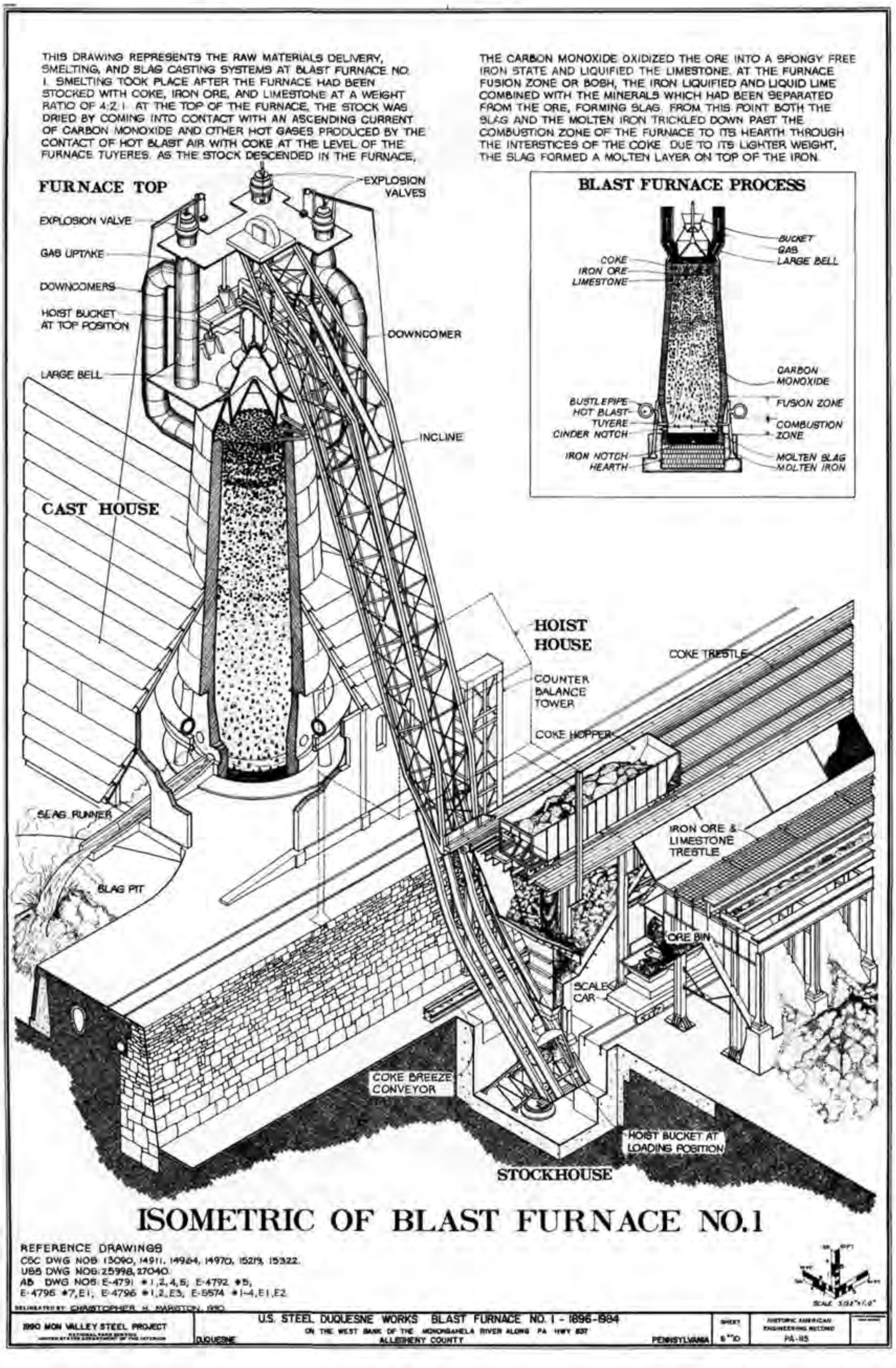
The influence of the Carnegie Steel Company in the creation of the modern American steel industry extended far beyond the construction of the Edgar Thomson Works. The company confirmed its leadership role in the industry by establishing "American practice" in the operation of blast furnaces and rolling mills. The standard for American blast furnace production was established between 1872-1900 by the gradual development of "hard driving" techniques at four local Carnegie facilities (Lucy Furnace Plant, Edgar Thomson Works, Duquesne Works, and the Carrie Furnace Plant). Predicated upon the introduction of larger blast furnaces, more powerful blowing engines, regenerative hot blast stoves, and an automatic raw materials storage, handling, and delivery system, 'hard driving' resulted in dramatic improvements in pig iron production, which rose from not more than 50 tons per day at a single furnace in 1872 to the world daily production record of 790 tons set by Carrie Furnace No. 3 in 1900. Three equally significant blast furnace plants from the period are extant—Edgar Thomson, Duquesne, and Carrie. Each one retains, if not its original equipment, the design principles which were developed between 1872-1900. [3]

The company established "American practice" in rolling mill operation by consistently employing the most productive equipment available. [4] Between 1890-1900, it installed an expensive new direct process for rolling rails, inherited from its purchase of the Duquesne Works, at

*(Mon Valley—continued on page 28)*

(**Mon Valley**—*continued from page 27*)

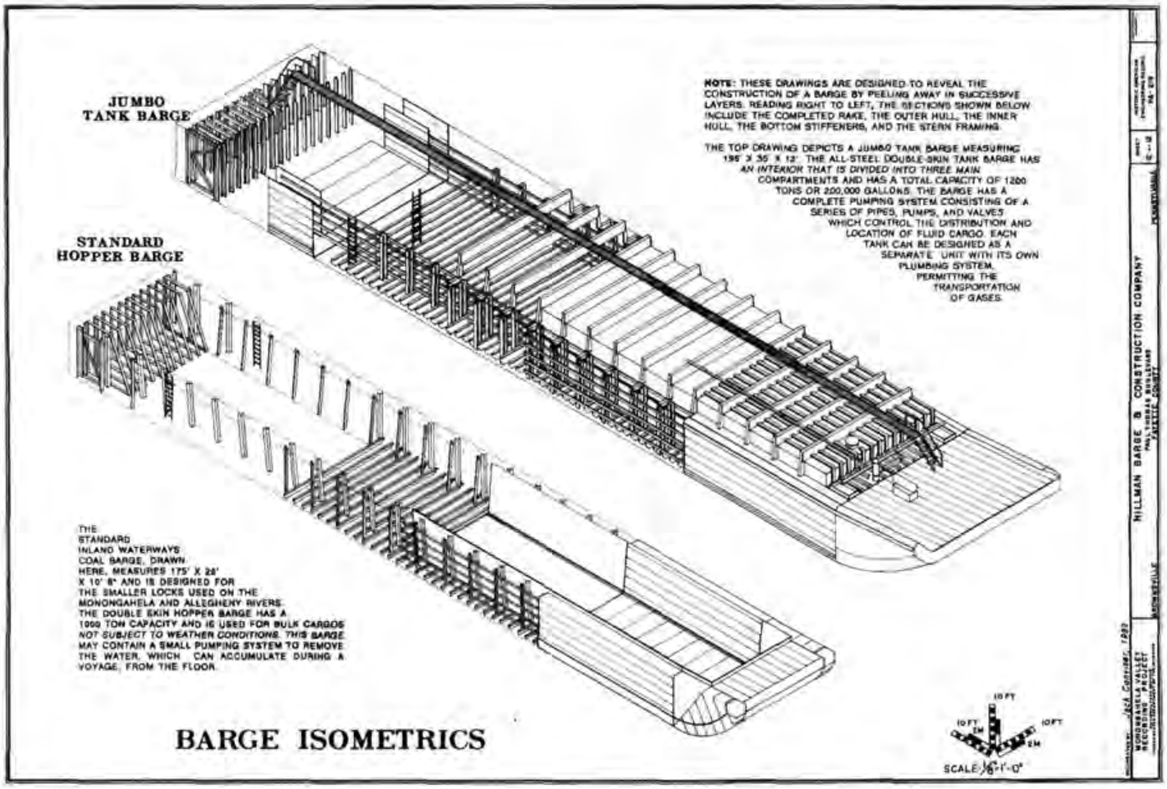
the Homestead and Edgar Thomson Works.[5] Several state-of-the-art structural and plate mills as well as a modern armor forging plant were also installed at the Homestead Works during the period.[6] The 48" steam-driven universal plate mill, installed at Homestead in the late 1890s, is the only extant rolling mill from the era. Recently dismantled by the task force, it is being stored in preparation for reassembly at a future steel heritage center.




Duquesne Blast Furnace No. 1, Duquesne, PA. Delineated by Christopher Marston, 1990, HAER.

The company's success in mass production and marketing had important consequences for the development of labor-management relations and the overall character of the heavy ferrous metals production industry. The installation of automatic steelmaking equipment and scientific product testing methods completely undermined the skills which made the Amalgamated Iron and Steel Workers of America viable. Although union rollers staunchly defended their lodges at Homestead in the 1880s, their defeat during the great Homestead lockout and strike of 1892 effectively vanquished craft unionism from the industry.[7]

Carnegie's financial success led the region's two largest wrought-iron producers, the National Tube Works Company in McKeesport and the Jones and Laughlin Company in Pittsburgh, into the exclusive production of steel goods.[8] By 1900 the steel mills in Allegheny County alone produced nearly 40% of the entire nation's steel ingot output.[9] After Carnegie Steel became the largest component of the United States Steel Corporation in 1901, it participated in the greatest single industrial expansion in American corporate history with the addition of four blast furnaces




**Barge Isometrics, Hillman Barge & Construction Company, Brownsville, PA. Delineated by Jack Conviser, 1992, HAER.**

(Carrie Nos. 6 and 7 and Duquesne Nos. 5 and 6), an open hearth steelmaking plant at Homestead and Duquesne, and several rolling mills at Duquesne and other local mills by 1910.[10] In addition, several fully integrated steel mills were built by other companies in the district between 1890-1907.[11]

A key element in the success of the region's leading steelmakers was their proximity to and control over the relatively narrow Connellsville and Klondike coal fields, known to contain the best metallurgical coking coal in the nation. This area not only served local needs but also those of other burgeoning steel districts in the Northeast and Midwest.[12]

Because of the many coal and coke facilities in the area, several important transportation companies were established to deliver their products. The Homestead Field Office has recently documented two of these, the Monongahela Railway and the Hillman Barge and Construction Company, both located in Brownsville, a part of the Klondike region.

The Monongahela Railway was incorporated in 1900 as a connecting line for the delivery of coal and coke to the trunk lines of the Pittsburgh and Lake Erie and Pennsylvania railroads. Between 1909-24, it built shops in South Brownsville to service its steam locomotives and cabooses. They included a roundhouse, erecting and machine shop, a car shop, a coal dock, and a sand house employing hundreds of skilled and unskilled workers.

The railway enjoyed great success during the first 30 years of its existence. Even after the local beehive coking industry gave way to the steel mill based by-product coking process after 1918, there continued to be a strong industrial and domestic demand for coal. Following World War II, however, public demands for cleaner burning fuels led to the enactment of local clean air legislation, which led to a slackening demand for the region's coal resources. The railway's problem was compounded by its conversion to diesel from steam locomotive power in the early 1950s, thereby significantly reducing its own coal needs, and by competition from river-going transportation firms.

The conversion to diesel engines, which, unlike steam locomotives, were serviced by interchangeable instead of custom-made parts, significantly reduced the skilled workforce by altering the technology associated with repair work. Likewise, the introduction of unit-trains, which eliminated the local need to make up delivery trains, eliminated most unskilled jobs. Drastically reduced labor costs, however, did not save the company from decline until recently. Financially stable today, it has just merged into the Conrail system. Only the engine turntable and the erecting and machine shops remain from its historic steam locomotive period.[13]

The Hillman Barge and Construction Company was founded by John H. Hillman Jr. The head of a leading entrepreneurial family in the Pittsburgh District, he abandoned his failing coal and coke holdings in the Klondike region and, in the American tradition of patriarchal entrepreneurship, moved a portion of his transportation company into Brownsville from Dravosburg in 1938, partly to provide work to his unemployed miners and coke workers. Originally conceived as a repair facility, the operation grew into a construction firm for barges and towboats.

The company has employed three different production systems during its existence, following progressively from batch to continuous flow methods. At present, it turns out one barge per day by integrating modern automatic cutting and welding equipment with historic hand welding methods in a circuitous process flow system. The company, which recently merged into the Trinity Group, has generally flourished, with the exception of a near decade-long experience in the 1980s when the region's steel industry went into severe decline.[14]

***(Mon Valley—continued on page 30)***

(*Mon Valley—continued from page 29*)

The Homestead Field Office has also documented an important early machine shop in the region. An increasing need in the early years of this century to service coal mining equipment led to a rapid expansion of the machine tools industry. One firm that was established partly for this purpose was W. A. Young & Sons Foundry and Machine Shop in Rices Landing. The foundry and belt-driven machine shop, established in 1901, served the needs of both individual customers and large mines in the area, never having more than a handful of operators throughout most of its existence. Inactive since 1969 and presently owned by the Greene County Historical Society, it remains in pristine condition. [15]

Finally, the field office has also documented the historic bridge over Dunlaps Creek in Brownsville. The Dunlaps Creek Bridge was built between 1836-39 as part of a Federal effort to repair the National Road. Designed and built under the supervision of Captain Richard Delafield of the Army Corps of Engineers, the bridge was the first cast-iron bridge in the country. Today, the 80' span arch bridge carries every form of modern vehicular traffic, 153 years after its construction. [16]

The historic steel, transportation, and machine tools industries are only part of the rich industrial legacy of the Monongahela River Valley. Through the ongoing sponsorship of the Steel Industry Heritage Corporation, the Homestead Field Office will continue to investigate and document the many significant industrial sites in the region.

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1 The study area encompasses all or parts of six counties in southwestern Pennsylvania. They are Allegheny, Beaver, Fayette, Greene, Washington, and Westmoreland counties.

2 Lynne Snyder, "Overview History of the Edgar Thomson Works," forthcoming paper prepared for the HABS/HAER Homestead Field Office. Formal photography of the Edgar Thomson Works was done by John McWilliams.

3 Joel Sabadasz. "The Development of Modern Blast Furnace Practice: The Monongahela Valley Furnaces of the Carnegie Steel Company, 1872-1913," (Homestead, 1990), unpublished paper prepared for and in the possession of the HABS/HAER Homestead Field Office. Measured drawings of the Duquesne Blast Furnace Plant were produced by Christopher Marston, Matthew Severence, and Joanna Winarska. Formal photography of the Duquesne, Edgar Thomson, and Carrie Furnace Plants was done by Jet Lowe, John McWilliams and Martin Stupich.

4 Henry Huse Campbell. *The Manufacture and Properties of Iron and Steel* (New York, 1907): 470.

5 Joel Sabadasz. "Overview History of the Duquesne Works," (Homestead, 1991), unpublished paper prepared for and in the possession of the HABS/HAER Homestead Field Office. Formal photography of the Duquesne Works was done by Martin Stupich.

6 Mark M. Brown. "Technology and the Homestead Steel Works: 1879-1945," *Canal History and Technology Proceedings*, Vol. 11 (March 14, 1992). The author prepared the research and much of the writing for this essay at the Homestead Field Office while an employee of HABS/HAER. Measured drawings of Press Shop No. 1 at the Homestead Works were produced by Craig Strong, Christopher Marston, Camilla Schlyter, and Patrick Williams. Formal photography was done by Jet Lowe and Martin Stupich.

7 David Brody. *Steelworkers in America: The Non-Union Era* (New York, 1969): 56-58.

8 Michael E. Workman. "Overview History of the National Tube Works Company," forthcoming paper prepared for the HABS/HAER Homestead Field Office. Formal photography of the National Tube Works was done by Martin Stupich.

9 Ralph J. Watkins, editor. *Industrial DataBook for the Pittsburgh District* (Pittsburgh, 1936): 32.

10 Mark M. Brown. "Technology and the Homestead Works;" Joel Sabadasz. "Overview History of the Duquesne Works;" "The Steel Corporation's New Construction for 1907." *The Iron Age*, Vol. 78 (December 13, 1906): 1616.

11 Kenneth Warren. *The American Steel Industry, 1850-1970: A Geographical Interpretation* (Oxford, 1973): 134-36.

12 Bruce Bomberger, William Sisson, and Diane Reed. "Draft National Register Nomination for Iron and Steel Resources of Pennsylvania, 1716-1945."

13 David Jardini. "Overview History of the Monongahela Railway Company." Unpublished paper prepared for and in the possession of the HABS/HAER Homestead Field Office. Measured drawings of the Monongahela Railway's South Brownsville Shops were produced under the general direction of Christopher Marston by Mark Pierson, John Eberly, Dana Peak, and Eva Mollnitz. Formal photography was done by Jet Lowe.

14 Kathleen Hopkins. "Overview History of the Hillman Barge and Construction Company," (Homestead, 1992), unpublished paper prepared for and in the possession of the HABS/HAER Homestead Field Office. Measured drawings of the Hillman Barge and Construction Company were produced under the general direction of Christopher Marston by Alan Loud, Jack Conviser, Brian Chevchek, and Kirsi Heininen. Formal photography was done by Jet Lowe.

15 Frances Robb, Mark Brown, and Christopher Marston, "Overview History of the W. A. Young and Sons Foundry and Machine Shop," (Homestead, 1992), unpublished paper prepared for and in the possession of the HABS/HAER Homestead Field Office. Measured drawings of the foundry and machine shop were produced by Christopher Marston, Evelyn Green, Roderick Fluker, and Paula Palombo. Formal photography was done by Jet Lowe.

16 Frances Robb. "The History of the Dunlaps Creek Bridge" (Homestead, 1992), unpublished paper prepared for and in the possession of the HABS/HAER Homestead Field Office. Measured drawings of the Dunlaps Creek Bridge were produced by Christopher Marston, Dana Peak, and Brian Chevchek. Formal photography was done by Jet Lowe.

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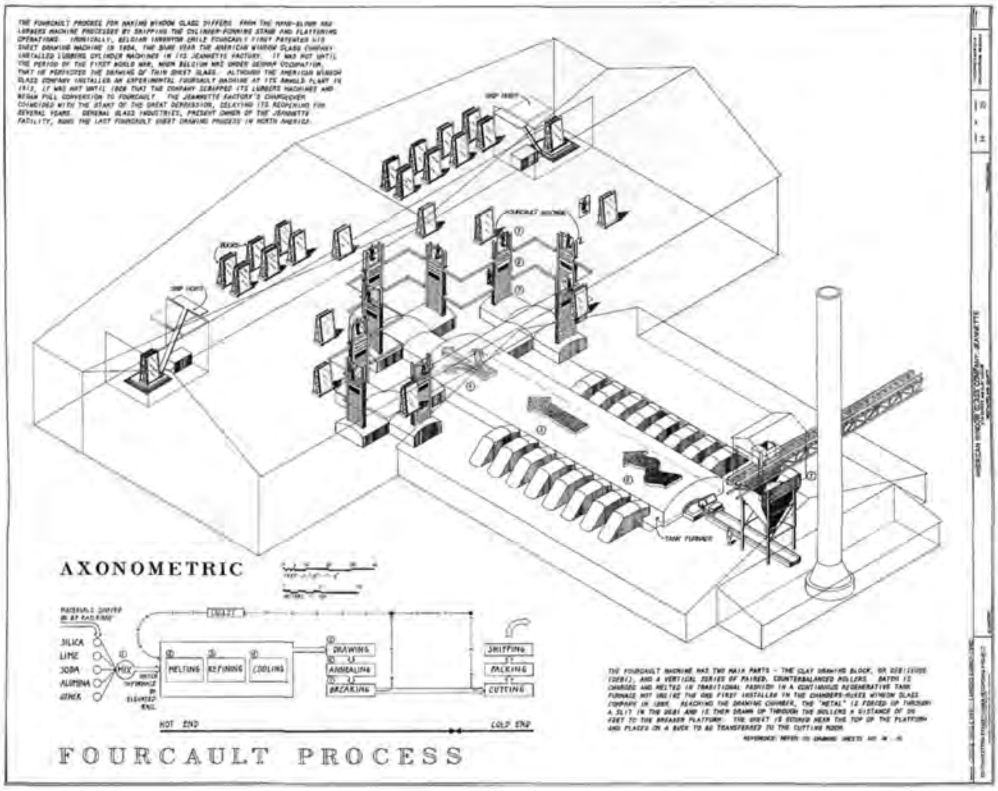
Joel Sabadasz is project historian for the HAER Homestead Field Office. A Ph.D. candidate in the History Department of the University of Pittsburgh, Sabadasz has worked in the Homestead office since its opening in 1989.



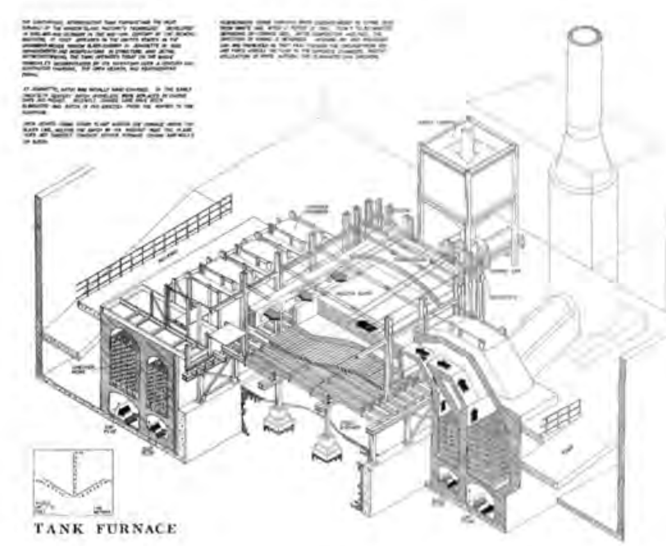

**Fourcault process for making window glass, patented by Belgian inventor Emile Fourcault in 1904. Installed at Jeannette in 1928. Delineated by Cecilie Trolle and Sanford Garner, 1992.**

*(**Glass**—continued from page 13)*

American Window Glass Company, employed as many as 1,500 workers during this time. The influx of workers into the enlarged and mechanized glass plants required more dwellings to house Jeannette's rising population. In addition to its residential buildings, the construction of new social halls and taverns reflected the city's building boom in the early 20th century. New waves of immigrants from southern and eastern Europe shaped the city's social, cultural, and political life. The HABS/HAER study looks at changes in Jeannette's residential and commercial development as a result of this population growth, and in relation to changes in factory technology, management, and the workforce. Using census reports, tax records, deeds, maps, and a survey of existing buildings, this study shows how managers, merchants, and workers affected the physical development of the city. The social and cultural character of Jeannette's various neighborhoods is linked to class, workers' mobility, and ethnicity.

The final draft of the study will incorporate the technological and social history of Jeannette with the HABS/HAER drawings and photographs of the window glass factory and buildings in the city. Prepared under the direction of HAER Historian Dr. Richard J. O'Connor, the manuscript has had a number of contributors, including Gary Koll, Joseph Socki, and Laura Dreimeyer.

**Double House, 312-314 S. Sixth Street, built around 1900. A typical brick double house in Jeannette constructed by a building speculator and occupied by skilled glass workers and their families. Photo by Matte Maldre, 1989.**




**Tank Furnace. The first one in the U.S. was constructed at Jeannette in 1889. Delineated by Amy McGroarty, 1992.**

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[1] This comprehensive inventory was conducted in concert with America's Industrial Heritage Project, a National Park Service effort in southwestern Pennsylvania which aims to preserve and interpret significant cultural resources related to the region's historic industry and transportation.

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Gray Fitzsimons, engineering historian for HAER, has served as HABS/HAER project manager for the division's multi-year documentation work in southwestern Pennsylvania.

(*Charleston—continued from page 15*)

our progress. We were very fortunate that we were able to photograph during all eight days we were in Charleston; only one day was partially interrupted due to rain. We did have to develop a strategy to take advantage of the different lighting conditions during the day. We had to shoot the facades along East Battery in the morning to take advantage of the rising sun, and we shot the facades along South Battery later to take advantage of the afternoon and evening sun.

Photogrammetry does have some inherent limitations when it is applied to architectural documentation. First, unlike a "typical" HABS/HAER project in which a complete structure is hand-measured, creating extensive field notes which can be used to verify accuracy, photogrammetry has minimal amounts of field notes in which to verify accuracy. Second, during the film developing and digitizing processes there is a potential for inaccuracies and distortions to occur. Third, you are only documenting what the camera sees. This could result in incomplete documentation, and makes documenting floor plans and structural systems difficult or impractical.

Although there are some limitations inherent in photogrammetry, there are many benefits in using this method of documentation. First, it has the ability to record a large complex of buildings in a relatively short period of time. Second, it can postpone the cost of developing scaled drawings until funding becomes available or drawings become necessary. Third, at the very minimum, it provides photographic records in a uniform format.

When considering photogrammetry as a possible method of documentation, a judgment has to be made as to whether the benefits of saving time and money outweigh the potential inaccuracies of plotting a photographic image. In the case of the Charleston Battery project, because of its scope, it was easily determined that photogrammetry was the most efficient method of documentation. If HABS/HAER had hand-measured all 26 facades, which is the "traditional" method of gathering field data, it might have taken a team of 10 members more than 3 months to collect the necessary data. Using the photogrammetric process, a team of four members, including the photographer, took eight days to gather the data necessary for photogrammetry.

The appropriateness of the photogrammetric process must be evaluated on a case-by-case basis. In addition to cost, the possible dangers of hand-measuring in a given case should be a factor in deciding whether to use photogrammetry. With developments of technology and computer software rapidly improving, applications of photogrammetry will probably increase until it becomes the preferred method of documentation.

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Mellonee Rheams is an architect with HABS and is currently project foreman on the Lincoln and Jefferson Memorials documentation project. Her previous HABS projects include the Au Sable Lighthouse in Grand Marais, MI, Snee Farm in Charleston, SC, and the White House.

Tom Behrens is an architect with HABS. His first involvement with the HABS program came while an undergraduate student at The Catholic University of America when he entered measured drawings of a Sears house in Cheverly, MD, in the 1989 Charles E. Peterson Prize.

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