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Recording Industrial Sites with CAD Technologies

The Linhof Metrika camera shown in this photograph was used to capture large format images of Eppleton Hall, shown in the background, which were used in the photogrammetric process. The photographs were digitized to aid in the generation of AutoCAD drawings. Photo by Todd Croteau, 1995.

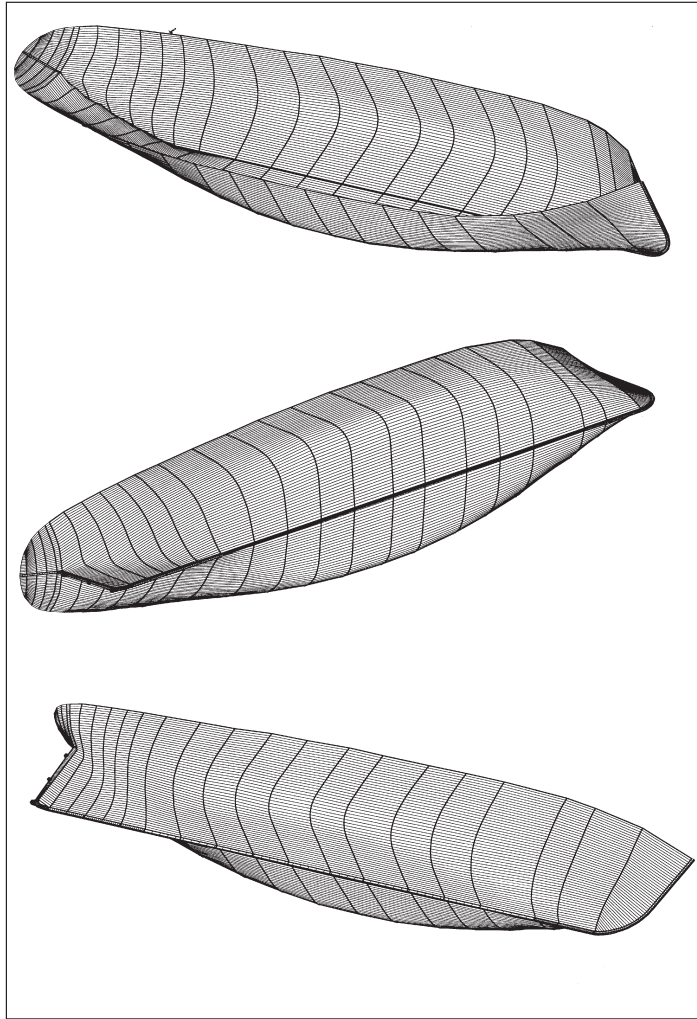
As technologies advance, more and more architectural establishments are creating and storing digital data to distribute information to their clients and the public. In the summer of 1991, the Historic American Buildings Survey began its first documentation project, the Lincoln and Jefferson Memorials, to be completed solely with the use of computer aided drafting (CAD).^{*} Shortly after this multi-year project was completed, the Historic American Engineering Record began using CAD technology on projects conducted in the Washington office CAD studio. As of 2000, in addition to the traditional hand drafting teams of students spread out across the country, HAER is operating selected CAD projects in temporary field offices staffed with student architects. HAER is embracing digital media and discovering new techniques that will allow the best documentation and interpretation of America's industrial heritage.

When HAER began documenting sites with the use of AutoCAD, the National Park Service's standard program for computer aided drafting, projects were most frequently delineated in the Washington, DC office, or occasionally contracted out to organizations with CAD capabilities. A team of staff architects would measure a structure or site and return to the office to create the set of drawings in a studio of workstations utilizing AutoCAD. The steam tug *Eppleton Hall* was among HAER's first structures to be drawn with CAD, in 1996. The San Francisco Maritime National Historical Park sponsored the project so that it would have a more comprehensive set of drawings. The vessel was measured by hand in the traditional manner and also with the aid of photogrammetry. Photogrammetry allows one to derive two- and three-dimensional measurements of a structure from a single or multiple photographs, greatly reducing time spent in the field. While still in the learning phase of photogram-



metric techniques, HAER gathered information on the vessel in both manners to insure the collection of all necessary information and to abate the need for further visits to the site. Using PhotoCAD, a photogrammetric software that works inside of AutoCAD, and typical CAD drawing techniques, team architects were able to create a set of lines drawings and three-dimensional hull models to add to the existing set of plans and profiles, as well as a complete new set of drawings in digital format. Original drawings were scanned and then placed in AutoCAD files as raster images or converted into vector entities. The files were then placed in title blocks in the standard HAER format and plotted onto sheets of Mylar. Normally, HAER provides only hard copies of the drawings to sponsors, but with CAD, digital files will be delivered and used in facilities management programs or curatorial records as they can easily be updated to reflect changes without having to create an entirely new drawing.

Photogrammetry and AutoCAD were also used to help gather information and create preliminary drawings for a summer team of hand drafting architects at Big Bend National Park in Texas in 1997. The Mariscal Quicksilver Mine and Reduction Works was part of HAER's hard-rock mining initiative to document outstanding



The steam tug Eppleton Hall (1914) was one of the first HAER projects completed with the use of computer aided drafting. These three-dimensional hull models show the form and curvature of the ship's hull from several views by capturing images of the same drawing from different angles. Drawing by the author.

remains of America's mining industry. To aid the team during the measuring and drawing phase of the project, staff architects took photos of the site and researched existing topographical maps that could be used to create a three-dimensional model of all the structures and their relation to one another within the landscape. This model was created in AutoCAD before the team's arrival in the park so that team members could focus on individual structures, the actual process of extracting mercury, and the steps through which the substance moved through the site. Once the team had determined which views to use in final drawings, the three-dimensional model was rotated to a particular angle and plotted to allow hand tracing of the structures in their proper positions within the steep site. The details of the structures were then added to the drawings from information collected by the team.

Having completed several projects within the Washington office, HAER decided to extend its use of CAD into the field with a full team of student architects working at CAD stations for a three-month period. In June 1999, seven architects and one historian began documenting the Jenkins Brick Company and the Western of Alabama Rail Shops in Montgomery, Alabama, as the first CAD team to operate totally on site for HAER. In preparation for the project, computers and peripheral items were rented from a local company, tables and chairs were purchased to accommodate the CPUs with their monitors, and an office space with the room and electrical power to run the equipment was acquired from Old Alabama Town. One computer was set up with Internet access to allow team members to perform research and communicate with the Washington office while the other CPUs were equipped with AutoCAD, Release 14. The sketching and measuring phase proceeded until enough information was accumulated and drawings could be assembled. Existing drawings such as maps were scanned and placed into the CAD drawings eliminating the time it would take to redraw or trace this needed element. A scanner also provided a means of digitizing photos to be used in a photogrammetric program, PhotoModeler, that uses raster images, viewable on a monitor, to obtain three-dimensional points, lines, and surfaces of any given subject. With this technology, the team was able to photograph and retrieve information from roof trusses and large structures that were inaccessible to hand measuring. While three-dimensional drawings can be useful in showing multiple views of a single structure, this project's supervisor chose to include particular isometric views that best described the structures along with typical plans, elevations, and sections. The delineators' attention to detail and textures made this a remarkable set of drawings for the project's sponsors and for the HAER collection.

HAER is currently researching new technology that will facilitate the production of documentation while still adhering to its strict standards. As with any hand drawn project, CAD projects also vary widely depending on the delineators and their particular techniques used to create drawings. Programs are becoming more and more advanced with methods of drawing, limited only by the creativity and determination of the user. One innovation that has come to HAER's

attention is the development of three-dimensional laser radar scanning and imaging. Instead of scanning photos and using photogrammetry, the laser can scan the structure directly in the field and collect thousands of data points from which accurately scaled 3D drawings can be extracted. While the considerable expense of this system prevents HAER from taking advantage of it presently, laser scanning is a potential method of quickly gathering data in the field. Surveying technology has also progressed over the past few years. HAER has now purchased an electronic Total Station that can be used to survey the topography of the landscape as well as architectural features. The Total Station uses an infrared or laser beam to find distances between points or the location of a group of points relative to one another. This machine has been used to measure the lines or curvature of ship hulls at the San Francisco Maritime National Historical Park and

also the fortified walls of Old San Juan in Puerto Rico. After points are gathered with the Total Station, the information may be downloaded into a CAD program to create a three-dimensional representation of the structure. With new courses in digital technology now being offered in universities and part of required curriculums, many students are coming to HAER with CAD experience that will inevitably lead to more projects being composed in a CAD environment, without excluding, however, all hand drawn components.

Note

* See Mark Schara, "Measuring Buildings for CAD Measured Drawings—The Lincoln and Jefferson Memorials," *CRM*, Vol. 16, No. 3, 1993, pp. 8-9.

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The Main Dryer Fan House at the Jenkins Brick Company (1906), Montgomery, Alabama, is one of few remaining structures still intact. This isometric cutaway of the fan house illustrates the delineator's attention to detail and the versatility of CAD techniques. Drawing by Sarah Goode, 1999.

