CRM Bulletin
Volume 9: No. 2 Cultural Resources Management • A National Park Service Technical Bulletin
April 1986

Restoring the Statue of Liberty

Sharon Ofenstein

Inspiration and perspiration—each has played a major role in the current restoration of the Statue of Liberty. Only the use of innovative, high-tech processes and materials made the project possible. But the application of these methods and materials has required the most diligent, persistent—even tedious—workmanship.

Consider, for example, the effort to replace nearly all of the statue's approximately 1,800 armature bars. (A few original bars were left in place, in the sole of the sandal on the right foot.) These 2- by 5/8-inch, ribbon-like iron straps form a grid conforming exactly to the inner surface of the statue's copper "skin," which measures 11,000 square feet. The skin is attached to the straps by means of U-shaped copper "saddles," which are pieces of metal bent over the bars and riveted to the skin.

This system was commonly used for sculptures of this size at the time the statue was created, in the 1880s. However, the method whereby the grid of armature bars was supported was unusual. It seems to have been part of the ingenious internal structure designed for the statue by the brilliant French engineer, Gustave Eiffel. Rather than being hung from the interior structural members, the armature bars were affixed to the outer ends of iron "flat bars" that projected upward, like struts, from the interior structure. Both the armature bars and the flat bars consisted originally of wrought iron, which was fairly supple. They allowed the skin to move in response to wind and thermal stresses.

System Fails

Nearly a century later, however, this system was failing. The statue had been maintained since its erection in 1886, but its large size and waterbound location tended to make care somewhat episodic. Nevertheless, the statue received over the years a series of repairs, as well as improvements to the visitor experience. An unusually thorough inspection in 1980, however, revealed that the iron of the statue's armature bars was reacting galvanically with the copper of the saddles and skin. Water was entering the interior of the statue through a variety of openings—in particular, at rivet holes, through the joints of the copper sheets, and around the deteriorated glazing of the flame of the torch. This water, made saline by the marine environment of New York Harbor, was acting as an electrolyte. It caused the iron of the armature bars, which was sacrificial to the copper of the saddles and skin, to corrode -- everywhere that it was in contact with the copper. The rust ate into the armature bars, reducing their strength. It also caused many saddles to become detached from the skin. This occurred because the growth of rust was generating more volume under the saddles than had been occupied by the original iron bars at those points. The slow but powerful expansion of the rust under the saddles would pull the latter's rivets right through the skin. This left holes that admitted more water, hastening the process of deterioration.

The 19th-century craftsmen who manufactured the statue knew that such a galvanic reaction could develop. Traces of asbestos felt impregnated with shellac were found in the vicinity of the saddles; they appear to have been part of an attempt to isolate electrolytically the iron from the copper. The materials chosen, unfortunately, were inadequate for the task. Asbestos could not prevent the movement of moisture through it. The shellac had this capability, but it was short-lived. By 1911, water penetration was severe enough to prompt

the application of a bituminous paint (coal tar) to the interior elements. A number of the armature bars were replaced, due to corrosion, in 1937-1938. By 1980, however, fully two-thirds of the approximately 1,800 armature bars were badly corroded, while all were affected to some degree. The iron flat bars supporting the armature bars were affected less, but some had buckled. It was clear that the existing destructive galvanic couple had to be eliminated. This would require the replacement of virtually all of the iron armature bars and flat bars. This work would constitute the most extensive aspect of the centennial restoration campaign.

New Materials

Advanced technology proved invaluable in selecting suitable replacement materials. The metal for the new armature bars and flat bars would have to be malleable, to replicate the complex forms involved, and galvanically passive with the copper, to prevent corrosion. At the same time, it needed to be as much like the original wrought iron as possible to comply with the Secretary of the Interior's Standards for Rehabilitation and because of the indeterminate nature of the statue's structural-stress system. The convoluted shapes of the armature bars in particular made precise stress analysis difficult; it was not known to what degree the new bars could deviate safely from the old ones. Since wrought iron had worked well mechanically for almost a century, it was thought best to find a new material that would match its modulus of elasticity.

Responsibility for the choice of materials rested with the National Park Service's North Atlantic Historic Preservation Center (NAHPC). Discussions with metallurgists revealed that copper alloys would be slightly more passive with respect to the copper saddles and skin, but that iron alloys would behave more like the wrought iron. Extensive tests by a number of interested parties were conducted under the supervision of the NAHPC. The copper alloys tested were stronger than the original wrought iron. In order to achieve the same modulus of elasticity, however, bars made of the copper alloys would have had to be thicker, and thus 30% heavier, than the original bars. Eventually, two types of stainless steel were selected. The flat bars, and the bolts of the armature bars' splice plates, would be made of Ferralium 225, a ferritic and austenitic (nonmagnetic) alloy. This duplex stainless steel exhibited minimal reaction with the copper; it offered thermal expansion and elasticity similar to that of the wrought iron, but was stronger. Ferralium would have been too difficult to shape into the complex forms of the armature bars, however. The metal selected for them was the extra-low-carbon, 316L stainless steel. It also exhibited minimal reactivity with the copper, and had a modulus of elasticity similar to the wrought iron. In addition, it had the same specific gravity as the wrought iron, and was stronger, but still easier to work with than the Ferralium. (The low carbon content of 316L makes it more makes it more ductile, as well as able to retain its resistance to corrosion through shaping treatments requiring high heat.)

As a further precaution, the armature bars and flat bars were to be sandblasted and cleaned with nitric acid before installation. This would remove from the surfaces of the bars bits of iron imbedded in them by the rolling mills—bits that would rust if not so treated. Finally, Teflon tape was to be used to isolate electrolytically the armature bars from the copper. The tape, which is backed with pressure-sensitive silicone adhesive, would be applied to the side of the armature bars facing the copper, and to the inner surfaces of the copper saddles. The Teflon has an indefinitely long lifespan, and a high resistance to the transfer of ions necessary for galvanic corrosion to occur. It also is the industrial polymer with the lowest coefficient of friction: it will hold up even during shearing motions. The silicone adhesive is particularly resistant to oxidative degradation, which tends to be associated with copper and copper oxide.

The advanced technology employed in the selection of replacement materials was of little use in the actual manufacture and installation of the bars. Traditional craft techniques were needed— albeit on an enormous scale that required unusual patience and persistence. Only four armature bars and their flat bars could be removed from any given area at one

time, and only four such areas—far apart from each other—could be treated simultaneously. Thus, only 16 armature bars and their flat bars could be removed at a time. The most complex armature bars, which required the use of a coal forge for the shaping of their replacements, were sent off Liberty Island to the workshop of Nab/Fiebiger—A Joint Venture. (These bars comprised approximately 200 of the 1,800 armature bars.) Less complicated bars were cold-worked by Nab/Fiebiger employees in the "restoration pavilion" that was set up on the island. Tools used included a 120-ton hydraulic press, an acetylene torch for heating difficult areas, and a variety of hand tools. The original bars had to be stripped of any paint on them, measured, and then carefully duplicated in new, annealed metal. A bar could require edge bending, flat bending, twisting, or any combination of these. The workmen started with the most complex part of each bar, and then proceeded to form it out to both ends. Continual precise measurements and comparisons were required to replicate each piece. In either case—whether a bar was forged or cold-worked—it was removed, and its replica was made and installed within 36 hours.

Saddles and Skin

Closely related to the replacement of the armature bars was the replacement of the approximately 3,000 copper saddles, and the repair of specific sections of the copper skin. (Several original saddles were left in place on the original armature bars retained in the right foot.) The failure of the saddles' attachments to the skin, as explained previously, was caused by the expansion of the rusting iron armature bars. New saddles and rivets were manufactured of toughpitch copper. They were reinstalled in the same locations as the old saddles, using the same rivet holes. On the whole, the copper skin is still in excellent condition. The deterioration of specific sections was caused by several factors. Comparative measurements were made by the NAHPC, using ultrasonic calipers, of the average thickness of the skin in many different areas. The original average thickness—3/32nds of an inch—has eroded only 4/1000ths of an inch in almost a century, despite the harsh environment. However, certain original conditions and later alterations caused particular areas of the copper skin to deteriorate to the point where they had to be replaced. For example, some sections of the skin are much thinner than other sections, due to the heavy amount of hammering they underwent during the fabrication process. The metal of the torch's filigreed handle was only one millimeter thick when the statue was new. A hundred years later, erosion of this element had reached a critical point.

Other, less highly worked areas of the copper skin also had deteriorated. Some of these were the result of the absence, blockage, or incorrect placement of "weep holes." These holes would allow water that did get into the statue to drain out. Wherever water collected and could not escape, metal-thinning corrosion occurred. This was the case with the tip of the nose, with three curls of the hair, and with the finial at the bottom of the torch's handle. The deterioration of the torch's flame, however, was caused by alterations made to it over the years, which inadvertently turned it into the statue's single worst source of water penetration. The flame originally was fabricated from solid sheets of copper. Immediately preceding the official dedication of the statue on October 28, 1886, however, two rows of holes were cut in the lower half of the flame, to permit its illumination from the inside via electrically powered arc lamps. An entire band of copper at the level of the upper row of holes was removed in 1892, and replaced with glass panels. Almost 25 years later, the entire surface of the flame was perforated with panes, creating a mosaic appearance. This form remained unchanged into the 1980s, but the inevitable failure of its elaborate glazing system allowed water to enter freely. The decision was made during the current restoration campaign to replace the flame, not repair it and lose its historic fabric. Also, repairing the mosaic-like glazing system would always be a liability, in a particularly inaccessible location. It was decided to remove the original, altered flame from the statue, and to display it in the lobby of the museum in the statue's pedestal base. A new flame would be made of gilded, solid-sheet copper formed to match the original design.

Working with Copper

Before any copper repairs were begun, however—even before any armature bars were replaced—the interior surface of the copper skin had to be stripped of the 1911 bituminous paint and a number of coats of other paint. Thermal, chemical, and mechanical means of removal were tested, to see which could remove the deposits without harming the copper. The low-dust abrasive, aluminum oxide was to be used to strip the paint from the iron interior structure. This method would have been too harsh for use on the copper. The NAHPC proposed the use of liquid nitrogen for cryogenic removal. Application of this product did achieve embrittlement and shedding of the paint layers. (Similar experiments with liquid nitrogen both prior and subsequent to this work failed to obtain the same success.) However, a dark-colored copper compound, caused by the interaction of the copper skin and the coal tar over time, remained. This had to be removed by blasting with bicarbonate of soda.

An essential component of the statue, both aesthetically and physically, is the green patina that has developed on the outer surface of the skin over the years. The new copper elements and the repair patches lacked this coloration. The flame of the torch was to be gilded, so that the new element was not a problem. The other repairs, however, would have been conspicuous. Thus, Les Metalliers Champenois treated the metal of the new torch with copper chloride, while the workmen of Nab/Fiebiger used copper sulfate on their repairs to achieve a greenish color quickly. This artificially accelerated patina will be supplanted gradually from behind by the patina that will develop naturally. The heads of all rivets were patinated with copper sulfate as part of their manufacture. The installation process frequently caused this layer to be knocked off. However, rivets that have lost their accelerated patina in this way still display a tendency to patinate at a rate faster than normal. Thus, the repair work soon will blend in with the statue's overall patina.

The condition of this overall patina has been a subject of intense concern during the current restoration. The presence of a stable patina is desirable, although it constitutes the corrosion of the outermost part of the statue, because it protects the rest of the metal below it. If the patina washes or blows off, new corrosion will take place on the exposed metal. Thus, the protection and enhancement of the existing patina has been a goal of the NPS investigators. This patina is nonuniform in color and thickness, and the NAHPC undertook extensive studies to ascertain its condition. Closest to the copper skin is cuprite (cuprous oxide). Above this is a blackish layer composed mostly of brochantite (copper sulfate tribasic). This layer can be seen in places on the statue where the topmost, greenish-blue layer is absent. The greenish-blue layer also contains mostly brochantite, but with a crystalline structure different from that of the blackish brochantite. The layer, in addition, contains antlerite (copper sulfate dibasic) in varying concentrations. The brochantite is a fairly stable product, and provides good protection for the copper statue. The antlerite is more porous, more soluble, and less protective.

The chief concern on the part of the NPS is the likelihood that the brochantite is being converted by acid precipitation (sulfuric acid) to antlerite, which tends to wash away. Examination of photographs taken in the 1950s shows a visible loss of the greenish color in some areas since that time. This is especially true on the north side, where weathering is most severe. Review of a study done in the 1960s suggests that the ratio of antlerite to brochantite has increased significantly since then. Coatings and chemical corrosion inhibitors are commonly used to protect outdoor sculpture. Their use on the statue was considered but rejected, due to their short lifespan, coupled with the large size and general inaccessibility of the statue itself. The National Park Service will continue to monitor and analyze the condition of the patina to determine exactly what is taking place.

Indeed, the NPS will continue to monitor and study many aspects of the Statue of Liberty long after the centennial restoration is completed. This launching of a long-term program of material and environmental investigation is perhaps one of the. most important legacies of the current repair work. As might be expected, new technology and traditional

practices will be combined in the undertaking. This information will help the NPS make informed, timely decisions about the care of the statue in the next 100 years and beyond.

The author is a technical publications writer/editor for the North Atlantic Historic Preservation Center. The center is part of the Division of Planning and Resource Preservation, North Atlantic Region (NAR). It contains laboratories and analytical equipment, and is staffed by historic preservation conservators and exhibit specialists who provide technical support to the parks primarily within the North Atlantic Region. Ofenstein was aided in the preparation of this article by Blaine Cliver, Chief of Historic Preservation for the NAR; John Robbins, Historical Architect for the NAHPC; Ed McManus, Objects Conservator for the NAR; and Carole Perrault, Historic Preservation Conservator for the NAHPC.

Historic Landscaping

John Donahue

Historic preservation helps us secure a sense of continuity with our heritage as well as provides educational experiences. One of the benefits derived from visiting historic areas is often the serenity and solitude found while walking through the grounds. Towering trees that have spanned generations represent a living history of their own. Very often the people honored at historic sites took an active role in establishing the environment surrounding their homes. Historic sites, parks, and memorials offer us the opportunity to immerse ourselves in the lifestyles of our predecessors for a brief time. The preservation of our rich heritage of historic structures is, by itself, a monumental task. Preserving a moment in time, however, involves more than the maintenance of structures and artifacts. The active preservation and restoration of the landscape is essential as well.

At the home of John Muir, in Martinez, California, the hand of the great naturalist can be seen everywhere in the landscape. The major elements of the landscape still remain and have flourished these last one hundred years. The remaining acreage of this once massive fruit ranch is a monument to his love of flora from the world over. A tour of the grounds will bring you upon Canary Island Palms (Phoenix canariensis), a Strawberry Tree (Arbutus unedo), huge Oaks (Quercus sp.), Pomegranates (Punica granatum), and a Big Tree (Sequoiadendron giganteum) that was planted by John Muir.

Continuing along the trail you come to the same fig trees (Ficus carica) that Muir once harvested. These fig trees and other plantings, however, present the observer with a dramatic realization of the ambiguities inherent in historic landscaping. Some of the specimens are over a century old and are senescent, diseased and aesthetically displeasing; yet they are dearly loved by visitors and still provide a bountiful harvest. This situation provokes questions concerning historic landscaping. What is the proper procedure when confronted with fifty foot trees that were actually very small during the period depicted? Should mature specimens be replaced with younger plants to match the factual record presented by photographs and diaries? Finally, does the National Park Service mandate require us to protect the historic trees or the historic scene?

In response to these questions, the staff at the Muir House has begun developing a landscape replacement and rehabilitation program. We carefully monitor the vigor of our seemingly ageless historic trees, and do not concern ourselves with the size of the specimens. Short lived, smaller specimens are replaced on a cyclic basis without much difficulty or disruption to the ambiance of the site. A variety of propagation methods are being successfully employed to ensure the integrity of the historic scene for the future. Several of the senescent fig trees have been removed and replaced with these newly propagated, genetically identical specimens. Each of these new plantings, as they grow, will not only be the same species and variety, but exactly the same tree. The success of this venture has inspired more experiments to generate proper plant material at a very low cost. Plans are also being finalized for the long term replacement of the orchards while maintaining the atmosphere of a mature fruit ranch. Obviously, the National Park Service mandate requires us to develop a response to each situation individually. Aesthetics, historical integrity, and public safety must all be considered when developing a course of action. Landscapes are, after all, dynamic systems subject to constant change and growth.

Historic landscape design and maintenance are artistic endeavors requiring both natural and cultural research support. Quality research is important for horticultural and historical reasons, and long term planning for replacement of the major landscape elements is critical. Balancing practical, aesthetic, and historical data is a difficult task with a rewarding outcome. Good management practices can implement the desired changes without

disrupting the visitor experience significantly. Preserving history through the living landscape paints a picture of days gone by for all to see and be part of.

The author is Resource Management Specialist at Morristown National Historic Park in New Jersey and until March was gardener at the John Muir National Historic Site since 1983.

Man in Space:

These Are The Voyages Of

Harry Butowsky

Humanity began a great adventure less than three decades ago— the exploration of space. Coupling new technology with their traditional zest for exploration, Americans have orbited the earth, landed on the moon, sent scientific probes to the planets, and hurled the first vehicles away from our sun on an eternal odyssey into deep space.

In the brief time since these epic achievements occurred, many of the facilities that served America's pioneer effort have been rebuilt or replaced; of others, only vestiges remain; and the remainder stand derelict, prey to vandals and the elements. Nevertheless, many Americans have come to believe that the facilities and locations associated with the space program deserve preservation as much as any other national historic treasure. This sentiment is shared by many in the executive branch, Congress, and the public.

As legislative support for this movement, Congress passed Public Law 96-344 in September 1980 to expand and improve the administration of the Historic Sites Act of 1935. The law required that the Secretary of the Interior, in consultation with the National Aeronautics and Space Administration (NASA), Department of Defense (DOD), and other concerned entities, conduct a study of sites and events associated with the theme, "Man in Space." The purpose of the study was to "identify the possible locations, components, and features of a new unit of the national park system commemorative of this theme, with special emphasis to be placed on the internationally historic event of the first human contact with the surface of the moon." The legislation further requested that the study investigate methods of safeguarding identified locations, structures, and instrumentation features, and for displaying and interpreting them to the visiting public. The law asked that a comprehensive report be submitted to Congress within one year.

The sites visited during the course of the study included all of NASA's field centers, Vandenberg Air Force Base, Edwards Air Force Base, the Alabama Space and Rocket Center, the Smithsonian Air and Space Museum, and the U.S. Army White Sands Test Facility. Due to the central role of the National Advisory Committee for Aeronautics (NACA), the parent agency of NASA, special emphasis was given to the original NACA field centers—the Langley Research Center, the Ames Research Center the Lewis Research Center, and the Dryden Flight Research Facility.

The first phase of the Man in Space National Historic Landmark Theme Study was completed by May 1984, then presented to the Secretary of the Interior's Advisory Board, October 1984. On October 3, 1985, Ann McLaughlin, Under Secretary of the Interior, signed a memorandum designating 22 of the sites in the Man in Space National Historic Landmark Theme Study as National Historic Landmarks. These 22 sites, discussed below, now join the more that 1,600 other sites, including Cape Canaveral Air Force Station, designated as National Historic Landmarks.

NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS WIND TUNNELS

- Variable Density Tunnel (Langley Research Center, Hampton, VA)
- Full Scale Tunnel (Langley)
- Eight-Foot High Speed Tunnel (Langley)
- Unitary Plan Wind Tunnel (Ames Research Center, Moffett Field, CA)

Taken together, these sites represent the excellent technological base of aeronautical research facilities created by NACA. The Variable Density Tunnel first used the principle of

variable density air pressure to test scale model aircraft. The Full Scale Tunnel was the first of its kind in NACA's inventory and contributed mightily to the design of an entire generation of aircraft in the 1930s and 1940s. Indeed, the versatility of the Full Scale Tunnel still demonstrates, 55 years after its construction, that it continues to be a major research tool in NASA's inventory and contributes to the design of new generations of aircraft. The Eight-Foot High Speed Tunnel is important as the first tunnel with a slotted throat design. It gave aircraft designers accurate data on airframe performance in the transonic range. The Unitary Plan Wind Tunnel represents NACA's continuing effort to update its wind tunnel inventory in order to provide the American aircraft and aerospace industry with the most advanced testing facilities in the world. Used extensively to design new generations of aircraft, its application eventually led to the space shuttle of today. These wind tunnels represent only a small fraction of the more than 65 wind tunnels currently in NASA's inventory.

ROCKET ENGINE DEVELOPMENT FACILITIES

• Rocket Engine Test Facility (Lewis Research Center, Cleveland, OH)
• Zero-Gravity Research Facility (Lewis)
• Spacecraft Propulsion Research Facility (Lewis Plum Brook Operations Division)

These sites illustrate the important role of the Lewis Research Center in developing hydrogen as a fuel for the Centaur and Saturn V rockets. The Rocket Engine Test Facility pioneered the technology for handling hydrogen as a rocket fuel; the Zero-Gravity Research Facility investigated the physics of handling liquids in a zero-gravity environment; and the Spacecraft Propulsion Research Facility enabled engineers at Lewis to hot-fire full-scale Centaur engines in simulated space conditions. The development of the Centaur and Saturn Rockets was crucial to both the manned and unmanned space programs of the United States.

ROCKET ENGINE TEST STANDS

• Redstone Test Stand (George C. Marshall Space Flight Center, AL)
• Propulsion and Structural Test Facility (Marshall)
• Rocket Propulsion Test Complex (National Space Technology Laboratories, MS)

These facilities represent the role of the Marshall Space Flight Center in the building and testing of actual space flight rockets. Before any rocket can be flown or used on a manned mission, it is first tested by firing in a static test stand to verify its status. The Redstone Test Stand was the first facility of this type, built at Marshall by Dr. Wernher von Braun. It tested the Mercury/Redstone missiles used to launch Alan B. Shepard and Gus Grissom on their first space launches. The Propulsion and Structural Test Facility was important in the testing of the Saturn lB vehicle, and represents the evolution of test stand technology from the days of the Army Redstone Missile to the Solid Rocket Booster used by the Space Shuttle of today. The Rocket Propulsion Test Complex was used by Marshall to test and man-rate all Saturn V rockets employed in the Apollo Program.

ROCKET TEST FACILITY

• Saturn V Dynamic Test Stand (Marshall)

This facility illustrates another facet of the building, testing, and man-rating of the Saturn V Rocket. Every Saturn V tested on the firing stand was then brought to the Dynamic Test Stand for mechanical and vibrational tests of its structural integrity. Part of the extensive ground testing program for the Saturn V Rocket, it was primarily responsible for the success of the American manned space program. Tests conducted here gave NASA and industry engineers their last chance to detect and correct any flaws in the fully assembled Saturn V.

LAUNCH PADS

• Launch Complex 33 (U.S. Army White Sands Test Facility, NM)

Launch Complex 33 at the U.S. Army White Sands Test facility was closely associated with V-2 and the origins of the American rocket program. It was developed specifically to accommodate V-2 rocket tests at White Sands. The V-2 Gantry Crane and Army Blockhouse represent the first generation of rocket testing facilities that would lead to the American exploration of space and the first manned landing on the surface of the moon.

APOLLO TRAINING FACILITIES

• Lunar Landing Research Facility (Langley)
• Rendezvous Docking Simulator (Langley)
• Neutral Buoyancy Space Simulator (Marshall)

Used to prepare American astronauts to land on the moon, the Lunar Landing Research Facility employed a mock Lunar Excursion Module attached to a fixed facility, which trained astronauts to fly the last 150 feet to the surface of the moon. The Rendezvous Docking Simulator is the only surviving trainer used to practice rendezvous and docking techniques needed to link two vehicles in space. The mastery of this skill was critical to the success of the Lunar Orbit Rendezvous technique for landing on the moon. The Neutral Buoyancy Space Simulator familiarized Apollo astronauts with the dynamics of zero gravity in preparation for working outside the spacecraft.

APOLLO HARDWARE TEST FACILITY

• Space Environment Simulation Laboratory (Lyndon B. Johnson Space Center, Houston, TX)

The Space Environment Simulation Laboratory man-rated and tested the integrity of the Apollo Command and Service Module, Lunar Module, and spacesuits under simulated space conditions. This testing was essential to the safety and well being of the astronauts.

UNMANNED SPACECRAFT TEST FACILITIES

• Spacecraft Magnetic Test Facility (Goddard Space Flight Center, Greenbelt, MD)
• Twenty-Five-Foot Space Simulator (Jet Propulsion Laboratory, Pasadena, CA)

These facilities illustrate the extensive ground support testing facilities needed for the American unmanned space program—the exploration of the near and deep space environment. The Spacecraft Magnetic Test Facility represents the Goddard Space Flight Center's contribution. This facility, the only one of its type in NASA's inventory, enables NASA to determine and minimize the magnetic movements of even the largest unmanned spacecraft, and thereby eliminate unwanted torques due to the interaction of the spacecraft with the earth's magnetic field. The Twenty-Five-Foot Space Simulator is the only NASA facility capable of producing true interplanetary conditions of cold, high vacuum, and intense solar radiation, coupled with a test chamber that can accommodate large space vehicles.

TRACKING STATIONS

• Pioneer Deep Space Tracking Station (Goldstone Tracking Station, CA)

This was the first antenna to support NASA's unmanned exploration of deep space. The technological achievements necessary to track deep space vehicles were first demonstrated and used at this site. Later, it was joined by dozens of additional tracking stations around the world.

MISSION CONTROL CENTERS

• Space Flight Operations Facility (Jet Propulsion Laboratory—JPL)
• Apollo Mission Control (Johnson)

These sites proved to be the very heart and soul of both the American manned and unmanned space programs. Projects Viking, Voyager, Pioneer, Ranger, and Mariner (under the control of JPL) opened new worlds to human exploration and understanding. The Space Flight Operations facility symbolizes this effort, as does the facility at the Jet Propulsion Laboratory. Apollo Mission Control at the Lyndon B. Johnson Space Flight Center represents Johnson's contribution to the American manned spaceflight program. It was to Apollo Mission Control that Neil Armstrong reported man's first landing on the moon (July 1969).

OTHER SUPPORT FACILITIES

• Rogers Dry Lake (Edwards Air Force Base, CA)

Although it is a natural resource, Rogers Dry Lake has been closely associated with the flight-testing of advanced aircraft that opened the way to space. The natural attributes of clean air, isolated location, ideal weather, proximity to variable terrain, and the large surface of the dry lake bed provide a natural laboratory in which to flight-test aircraft on the cutting edge of aviation and aerospace technology. Starting in 1947 with the flight of the Bell X-1, the first plane to break the sound barrier, and continuing on to the landing of the Space Shuttle Columbia in 1981, Rogers Dry Lake has been the scene of some of the most important developments in aviation history.

In addition to the facilities designated as National Historic Landmarks, the Secretary of the Interior's Advisory Board deferred consideration of the Saturn V Rocket at the Alabama Space and Rocket Center because of questions concerning the appropriateness of designating objects in museum-like settings. After the National Park Service has prepared written guidance on this subject, the Saturn V will be resubmitted to the Board for action.

The Man In Space project represents an exciting preservation and interpretive challenge for the National Park Service, the National Aeronautics and Space Administration, the United States Air Force, the United States Army, and the Alabama Space and Rocket Center. Project sites scattered across the country have varying degrees of accessibility and represent different aspects of the space program. Many of these sites will also continue to evolve in order to support new programs of the National Aeronautics and Space Administration. It is hoped that the Alternatives Study to follow the Man in Space National Historic Landmark Theme Study will provide creative solutions for the preservation and protection of these facilities as well as their interpretation to generations of Americans yet to come.

The author is Staff Historian, WASO. A copy of his full report on the Man In Space sites is available through the National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22151. Ask for NTIS #80108822/PCA15/MFA01 .

Management of Archeological Collections

Emily Feldman

In June 1984 Hopewell Furnace National Historic Site, Pennsylvania, began the long and arduous project of organizing, documenting and preserving its extensive archeological collections. The collection consists of over 200 field collections and 47 formal archeological excavations numbering approximately 250,000 artifacts. The artifacts have been accumulating for nearly 50 years and are located in a small storage room. Field artifacts and excavations are all being stored in specimen cabinets by accessions to preserve their archeological integrity and usefulness. Such a storage arrangement is possible because most of the artifacts are iron, slag, rock, ceramic or glass, all of which can be stored compatibly. Shelf list cards are used to identify the contents of each drawer and to control inventory. The cards also note any significant problem with provenience and other identifying numbers associated with each artifact. Previously, few of the archeological collections had been systematically stored, and many field specimen groups had broken up. Now, artifacts with the same provenience are stored together when feasible.

As archeological artifact records had been maintained inconsistently, excavations had to be identified in the accession records and archeological information collected from various files at the site. Information was then centralized in the accession folders. Delicate original information is being copied on archival bond paper if there were no working copies. Artifacts and their documents are cross referenced on the catalog cards. The catalog card serves to index all the available material for any given artifact.

Physical improvements in the artifact storage facility include the acquisition of 35 new specimen cabinets, dollies, a dehumidifier and two document cabinets. This has allowed the artifacts to be removed from the stacked wooden fruit crates in which they were originally stored on open shelving. In addition, older specimen cabinets were upgraded by the installation of seals and locks. Improved facilities have allowed Hopewell to reorganize the storage facility and upgrade the manner in which the artifacts are stored.

The author is museum technician at Hopewell Furnace National Historic Site.

Origins of the National Historic Preservation Act of 1966—Part II

Ernest Allen Connally

In the post-war years of prosperity, expansion and development, the damage inflicted on the historic heritage by large-scale private and public works, especially federally-assisted projects, prompted a rising demand for increased protection of historic sites and buildings. The response at the national level, beginning about 1960, was a steady stream of legislative proposals and special reports that culminated in the National Act of 1966

McDowell and MacDonald

Two early legislative initiatives anticipating the Act of 1966 were the bills introduced in the House of Representatives in 1961 by Harris Brown McDowell, Jr. of Delaware and Torbet Hart MacDonald (1917-1976) of Massachusetts. Both would amend the Act of 1935 by requiring the Secretary of the Interior to request local governments to furnish lists of historic properties valuable to the localities and to publish the lists. Thenceforth, the head of any federal agency undertaking a project involving federal funds would have to be sure, before any expenditure, that the lists had been consulted and that the effect of the project on listed properties had been taken into account. The opportunity for full expression of views on a project was to be afforded in public hearings held at appropriate stages of its development.

The Department of the Interior supported the objectives of the bills but recommended enactment of a substitute, to be a new act rather than an amendment. In addition to the provisions described, it required uniform criteria, derived from those employed in the Historic Sites Survey. This was to facilitate rational integration of the state and local lists into the national registry, while encouraging the use of data from the national survey in the state and local surveys, and vice versa. The substitute would also provide limited financial assistance to the states on a matching basis for five years, in order to ensure a high degree of reliability in the lists and to encourage their preparation without delay. Although the National Park Service forwarded the proposal again in 1962, it never reached hearings.

The Williamsburg Seminar

The United Nations Educational, Scientific and Cultural Organization (UNESCO) designated 1964 as International Monuments Year, called American Landmarks Celebration in this country. A preparatory conference, the Seminar on Preservation and Restoration, was held in September 1963 in Williamsburg, Virginia. Sponsored jointly by the National Trust and Colonial Williamsburg, it included participants from abroad. The published proceedings were entitled Historic Preservation Today (1966).

Meanwhile, the seminar's report was adopted by the National Trust at its annual meeting held in San Antonio in October 1964. As the "Report on Principles and Guidelines for Historic Preservation in the United States," it envisioned the heritage as extending beyond individual buildings to include districts and landscapes. It emphasized standards for surveys and adequate registers at the national, state, and community levels. It urged the incorporation of historical and aesthetic values into planning at all echelons of government. It recommended that local authorities institute controls on the demolition of historic structures, while offering tax abatement to encourage their preservation. It included statements on restoration, districts, and training. And it recognized a national obligation to cooperate in international efforts to promote preservation.

UNESCO and ICOMOS

International preservation activities had accelerated as the forces menacing the environmental and cultural heritage in the industrialized nations were rapidly becoming evident around the globe. UNESCO had issued two official, professionally-founded recommendations to member states on subjects of some urgency: International Principles Applicable to Archaeological Excavations (1956), and Safeguarding the Beauty and Character of Landscapes and Sites (1962). Under French auspices, the First International Congress of Architects and Specialists of Historic Buildings was held in Paris in 1957, to re-establish contacts, exchange information, and consider common problems. With support from UNESCO, the Second International Congress was held in Venice in May 1964, in the course of International Monuments Year. The American delegation included representatives of the National Park Service and the National Trust.

The Congress of Venice adopted the statement of principles known as the Venice Charter. Also, recognizing the advantages of collaboration, it recommended the creation of an international nongovernmental organization to be named the International Council on Monuments and Sites (ICOMOS), which came into being at a constitutive assembly in Warsaw, June 1965. Robert R. Garvey, Jr., Executive Director of the National Trust, was elected one of the three vice-presidents. Seated in Paris to supplement the work of UNESCO, ICOMOS functions as a professional instrument of international cooperation to advance the preservation, documentation, restoration, enhancement, and use of historic sites, buildings, and ensembles.

Conference on Natural Beauty

Meanwhile, at home, the President's Task Force on the Preservation of Natural Beauty, chaired by Charles Haar, submitted its report in November 1964. Symptomatic of the prevalent concern for city problems was the task force's inclusion of urban design within the array of subjects related to countryside and natural beauty. Holding that a requisite for urban quality was the retention of buildings and areas of historic and aesthetic significance, and noting that the federal government had been moving slowly in such matters, the Task Force offered pointed recommendations.

The National Park Service should be required to complete, within five years, a comprehensive inventory of the nation's historic properties based on a broadened concept of what ought to be saved. State governments and professional organizations should be involved in its preparation. The Department of the Interior should follow through with a workable system for the protection of those assets. There should be a board with power to veto federal expenditures when necessary to prevent federally financed projects from conflicting with historic preservation. Further, federal loans and matching grants should be made available to state and local governments for the historic preservation task; and the National Trust should be given a fresh start through legislation authorizing it to receive grants from federal programs and an annual appropriation of $2 million to be matched by private donations. Housing regulations should be revised to suit the repair and further use of old buildings as well as new construction. Finally, the owner of a property in the inventory should be entitled to a federal income-tax deduction for expenses necessary to preserve or restore it.

In the subsequent White House Conference on Natural Beauty, May 1965, the panel denoted "The Townscape" was chaired by Edmund N. Bacon of the Philadelphia City Planning Commission. The "action proposals for historic preservation" in his report reiterated the basic recommendations of the task force, but with a specific addition: "the creation of historic districts, wherever appropriate, including the whole of some historic towns." Also, his report advocated overhaul of tax policies "to encourage greater private investment in the preservation of approved historic and landmark structures and areas." The proceedings of the conferences were published as Beauty for America (1965).

Landmarks of Beauty and History

President Johnson had called for the White House Conference in his Message on Natural Beauty of February 8, 1965. In it, he complimented the citizenry for "rallying to save landmarks of beauty and history," declaring that the government should do its share to assist those efforts. Pledging support for the National Trust, he added, "I shall propose legislation to authorize supplementary grants to help local authorities acquire, develop and manage private properties for such purposes." He also commended the Registry of National Historic Landmarks as "a fine federal program with virtually no federal cost."

Secretary Udall's prompt response was to direct the National Park Service, in conjunction with the Bureau of Outdoor Recreation, to draft legislation authorizing grants to assist local authorities to protect "landmarks of beauty and history." (The Department of the Interior already had an active grants program for purposes of outdoor recreation.) The National Trust entered an initiative for financial assistance, according to the recent recommendations. After lengthy consultation, a draft provided $2 million annually in direct aid, but the final version provided a maximum of $2 million annually on a matching basis. On that basis, the proposal was cleared by the Bureau of the Budget on September 30, 1965. At that time, it appears, the Department was prepared to support matching grants only for the National Trust.

Nevertheless, when the Special Committee on Historic Preservation began its work in October 1965, Director George B. Hartzog, Jr. quickly formed a six-member team to work with the committee, and in November he sent its chairman a staff paper outlining a "new program of historic preservation." Its salient points were grants to the states and the National Trust, legal status of registered districts as well as landmarks, and procedures for their limited protection. More tentative suggestions included loans for rehabilitations, tax-deductibility of preservation costs, and an easement program, among others.

On November 30, 1965, the Secretary of the Interior submitted to the Bureau of the Budget a draft bill to implement a Presidential conservation program. Title II pertained to historic preservation. But this development was being rapidly overtaken by the report of the Special Committee.

Special Committee on Historic Preservation

The most decisive turn on the road from 1935 to 1966 was the report of the Special Committee on Historic Preservation. The idea of a timely study with commanding publicity and prestige was conceived in the summer of 1965 by Laurance G. Henderson (19231977), who was then Director of the Joint Council on Housing and Urban Development, with the collaboration of the noted planner Carl Feiss. It was an initiative for Albert Rains, Chairman of the Subcommittee on Housing, Committee on Banking and Currency, in the House of Representatives, although he soon retired from Congress. With financing from the Ford Foundation and an anonymous donation, the Special Committee was speedily organized under auspices of the United States Conference of Mayors, which, since its creation in depression year 1932, has had the role of speaking to the federal government on behalf of the nation's urban interests.

The committee became known as the Rains Committee after its chairman. The other members were Senator Edmund S. Muskie of Maine, Representative William B. Widnall (1906-1983) of New Jersey, Governor Philip H. Hoff of Vermont, Professor Raymond R. Tucker of Washington University (formerly Mayor of Saint Louis), Gordon Gray (1909-1982), Chairman of the Board of Trustees of the National Trust, and Laurance G. Henderson. Members ex officio were the heads of federal agencies with programs involving historic properties: Interior, Commerce, Housing and Urban Development, and General Services. Director Hartzog represented the Secretary of the Interior. Carl Feiss was technical director of the committee, and among its consultants were John J. Gunther, Executive Director of the U.S. Conference of Mayors, Robert R. Garvey, Jr. of the National Trust, and Ronald F. Lee of the National Park Service.

In the autumn of 1965, the Rains Committee and its entourage studied preservation in principle and practice during a month's tour of Britain, France, the Netherlands, West

Germany, Poland, Czechoslovakia, Austria, and Italy. Meeting in New York on November 3, 1965, the whole committee, urban in its orientation, reviewed a range of proposals and settled on final recommendations.

Early on, it had been decided to produce a report, as a book, to be ready for the opening of the second session of the 89th Congress in January 1966. The National Trust provided staff work for preparation of the publication, which appeared on time under title With Heritage So Rich (1966, reissued 1983). The report contained a foreword by the First Lady, Mrs. Johnson. After many essays and illustrations, it concluded with the committee's findings and recommendations. Barely six months had elapsed since inception of the committee. It was a spectacular performance.

Although the Rains Committee's report included many recommendations for state and local administrative measures and legislation, its principal thrust was aimed at an effective federal program. Chiefly, it recommended legislation to affirm a strong national policy of historic preservation at an enlarged dimension.

It recommended that the National Park Service be empowered to consolidate federal inventory and survey programs in a national register, and to obtain appropriations for its administration. It proposed authority to make grants to state and local governments to carry out a survey and inventory program in coordination with the National Park Service. The national register would be published regularly and distributed by the National Park Service. Based on carefully prepared criteria, it would comprise three categories of historic properties. The highest classification would be reserved for prime national monuments protected by a pre-eminent Congressional enactment prohibiting their demolition or alteration without approval of the advisory body proposed in the report. The second category would be for lesser properties of merit, eligible for the range of assistance recommended in the report. The third category would consist of properties of local concern, the preservation of which would be left to decision and initiative at that level.

The report called for establishment of an adequately staffed advisory council on historic preservation, composed of a membership representing major federal agencies involved with preservation, state and local governments, and public and private organizations concerned with preservation or urban development. The council would have the duty to advise the President and the Congress on historic preservation as it affects the national welfare. It would foster studies to assist state and local governments in measuring up, and it would develop policies and guidelines to resolve federal conflicts affecting historic preservation. It would support the national register as an instrument of national preservation policy.

The report also urged obligatory review of the location status of historic sites and buildings in areas scheduled for federal projects. The survey should be completed prior to undertaking any federally-aided work. In the event a survey had not yet been done for the national register, the mandated immediate survey, financed by the agency involved, would be required to accord with the register's standards.

Further proposals included liberalized loans to assist private individuals and groups to acquire and rehabilitate historic structures. The acquisition of registered historic structures should count as an eligible part of the non-cash contribution of a community's portion (usually 1/3) of the cost of an urban renewal project. The Internal Revenue Code was singled out for amendment to permit income-tax deductibility for gifts of easements and the conveyance of registered historic properties to units of government, as well as an owner's expenses in the preservation and restoration of registered properties. It was also proposed that it allow donation to the National Trust of registered properties in lieu of equivalent estate taxes.

The report recommended grants to the National Trust on a matching basis (2/3 Federal to 1/3 Trust) to strengthen its programs. Finally, it proposed that the United States provide financial assistance for UNESCO preservation programs, for the International Centre for the Study of the Preservation and Restoration of Cultural Property (then known as the Rome Centre, now as ICCROM), and for ICOMOS.

The National Historic Preservation Act

On February 23, 1966, President Johnson sent to Congress his Message on the Quality of the Environment. In it, he stated:

> Historic preservation is the goal of citizen groups in every part of the country. To help preserve buildings and sites of historic significance, I will recommend a program of matching grants to States and to the National Trust for Historic Preservation.

Immediately, the legislative proposal previously developed in the National Park Service was revised and sent forward. It was largely the work of Herbert E. Kahler and Frank E. Harrison. As a service requested by Laurance Henderson on behalf of the Rains Committee, the Department's Legislative Counsel also prepared a draft bill based on recommendations in With Heritage So Rich. Thus, in March 1966 there were introduced in Congress three sets of bills that would assist historic preservation.

Interior's bill was introduced by the apposite committee chairmen in each chamber, namely Henry M. Jackson (1912-1983) in the Senate and Wayne N. Aspinall (1896-1983) in the House of Representatives. The bill embracing the recommendations in the Rains report that applied to Interior was introduced by the Congressional members of the committee: Senator Muskie and Representative Widnall. These two sets of bills were referred to the Committees on Interior and Insular Affairs. The third pair represented the Special Committee's recommendations applicable to HUD and were thus referred to the Committee on Banking and Currency.

The four bills pertaining to Interior came out of the legislative process seven months later as the National Historic Preservation Act that was signed into law by President Johnson on October 15, 1966. It was a distillation of the ideas and proposals that had been fermenting over the previous seven or eight years.

The act declared that "the historical and cultural foundations of the Nation should be preserved as a living part of our community life and development." Noting the threats of rapid development and large-scale construction, it found it necessary for the Federal Government to accelerate its preservation activities and to assist the states, local governments, and the National Trust in their efforts. Its three basic provisions are now well known. It authorized the Secretary of the Interior to expand and maintain the National Register, embracing a broad range of historic properties. It authorized matching grants to the states and to the National Trust. And it established the Advisory Council on Historic Preservation.

The ultimate content of the act resulted from the inevitable give and take of the legislative process in reducing and adjusting two sets of bills to one rational whole on which consensus could be achieved. And a final committee report in the House of Representatives reaffirmed "that the national historic preservation effort should continue to be, as it has been in the past, a function of the Department of the Interior and particularly of the National Park Service."

National Register

In arriving at consensus, one of the questions was the administrative location of the National Register. At one juncture in the deliberations of the Rains Committee it was suggested that the National Register should be attached to the Advisory Council, which would be an independent agency. But George Hartzog was able to satisfy the committee and eventually the Congress that the National Park Service already had a functioning mechanism in the National Survey of Historic Sites and Buildings and its product, the Registry of National Historic Landmarks. The expanded National Register had only to branch out from that existing stem. That view prevailed and there is only one National Register. Consequently, the official federal definition of what is historic is that which is included in the National Register or is eligible to be registered.

Notwithstanding the recommendations of the White House Conference on Natural Beauty, none of the bills initially included historic districts in the concept of the National Register. The omission was corrected, however, after the testimony of Senator Edward M. Kennedy of Massachusetts emphasized that "the creation of historic districts should be an important part of our national policy toward historic preservation." Broadening the range, the act finally specified "a national register of districts, sites, buildings, structures, and objects significant in American history, architecture, archeology, and culture, hereinafter referred to as the National Register. . ."

Divergent standards of importance for registered properties had to be reconciled. The bill embodying the recommendations of the Special Committee proposed three distinct grades of significance: national, regional or state, and local. The Interior bill made no such distinctions, and HUD objected to federal determinations governing how local activities would meet preservation criteria, holding that the National Register should be merely advisory. The differences between the two departments were resolved in a report from the Bureau of the Budget, speaking the voice of the executive authority, to the effect that historic structures eligible for federal assistance should be those on the national register expanded and maintained by the Secretary of the Interior. And ultimate legislative clarification was expressed in a Senate subcommittee report on the final substitute bill, explaining that it "would permit the Department of the Interior to extend its national register program to include historic properties of national, State, regional, or local significance . "

On objections to including properties of local significance in the National Register, and the cost that it would entail, Interior's bill failed in the House of Representatives. However, Gordon Gray's timely intercession with key committee chairman resulted in a rule allowing the measure to be brought to the floor of the House, where it passed by voice vote in tribute to Leo W. O'Brien (1900-1982), a retiring member of Congress from Albany, New York, who was formerly a journalist involved in environmental causes. Since the measure had already passed the Senate, this rescue was critical to final enactment, which occurred within five days.

Grants-in-Aid

As to financial assistance, both sets of bills provided grants to the states at 100% federal funding, consonant with the Act of 1935, for surveys and statewide plans. Both also authorized matching grants to the states on the basis of 50% federal for the acquisition and restoration of historic properties. The Widnall-Muskie bills would grant 75% federal assistance to the National Trust for projects pursuant to its charter, while the Aspinall-Jackson bills would limit grants to the National Trust at 50% federal funding for its properties and programs. The final result was authorization for matching grants to the states for both major program components on the principle that federal assistance not exceed 50% of the cost. On the same basis, grants were authorized for the National Trust "for the purpose of carrying out the responsibilities of the National Trust."

The initial authorization was $2 million for the first year. It was intended for the National Trust, at the amount cited in pre-legislative recommendations, on the understanding that it would take a while for the states to prepare to participate in the program. The initial authorization rose thereafter to $10 million per annum for three years, the bulk above the National Trust's allotment going to the states for the conduct of surveys and the preparation of plans. It was envisioned that financial assistance at this level would make it possible to take a reliable measure of the preservation need, after which authorizations more accurately calculated for their purpose would be sought.

Advisory Council

Title II of the act established the Advisory Council on Historic Preservation, composed of the heads of certain federal agencies and the National Trust with other members appointed by the President. Due consideration was to be given to the selection of officers of state and local governments and "individuals who are significantly interested and

experienced in the matters to be considered." The Council was given the function of advising the President and the Congress on issues relating to historic preservation. It was further charged with recommending measures to coordinate federal, state and local activities, with recommending studies on legislative and administrative items, and other similar duties. Section 106 of the Act required the heads of federal agencies to take into account the effect that any undertaking of an agency might have on a property included in the National Register and to afford the Advisory Council a reasonable opportunity to comment on the undertaking.

The Council's comments under Section 106 were meant to be critical assessments early in the planning stage of federal or federally-aided projects. It was an intentional feature of the act—a federal law—that its restrictions applied only to federal agencies of government, not to private property owners. Of course, comments are not so strong as the power of veto recommended by the Task Force on Natural Beauty, but it was early recognized that the heads of federal agencies could not properly give away their responsibility to make decisions. It was found reasonable, however, to require that decisions be made within a new framework of accountability, based on the content of the National Register.

The Bureau of the Budget insisted that the Advisory Council not duplicate functions of existing federal agencies. It was to be purely advisory, not program-operating; it would "recommend" studies, not "conduct" studies. Because of its relationship to other agencies, the Council was conceived as an independent body by the Rains Committee, which once considered that it would be most effective in its role if annexed to the Bureau of the Budget. Statutory establishment of the Advisory Council was proposed only in the bills developed from recommendations of the Rains Committee. Nevertheless, the Department of the Interior embraced the idea; and in the final construction of the Act of 1966, while the Council was recognized as having the function of an independent agency, it was decided for administrative practicability to shelter the fledgling within the National Park Service. The Director of the National Park Service was named ex officio Executive Director of the Advisory Council on Historic Preservation. (The Council became an independent agency by amendment of the act in 1976.)

Demonstration Cities and Metropolitan Development Act

The set of bills stemming from the Rains Committee's recommendations applicable to the Department of Housing and Urban Development came into law as the Demonstration Cities and Metropolitan Development Act, approved by President Johnson on November 3, 1966. Seen as ultimate atonement for the sins attributed to urban renewal, the act allowed historic and architectural preservation in urban renewal plans and eligible project costs. It also authorized grants to cities to make surveys of historic or architecturally valuable properties, and it provided for preservation demonstration grants. Overlapping the Interior program, it authorized matching grants to states and local public bodies for the acquisition and restoration of historic sites and structures in urban areas. To determine eligibility for inclusion in the program, properties would be judged against criteria comparable to those of the National Register. It also authorized a separate program of grants to the National Trust for restoration projects.

Department of Transportation Act

A third enactment contained a response to the widespread criticism of federally-aided highway construction. Also on October 15, 1966, President Johnson signed the Department of Transportation Act. While establishing a new federal agency, the law stated a policy to preserve historic sites as well as natural resources of scenic beauty and recreational value. Section 4(f) of the act enjoined the Secretary of Transportation from approving any project requiring the use of land from a public park, recreation area, wildlife and waterfowl refuge, or historic site, unless there was no feasible and prudent alternative and all possible planning was done to minimize harm to such property.

The Preservation Congress

The three enactments earned the 89th Congress the distinction "The Preservation Congress." Central to national policy was the National Historic Preservation Act of 1966. From its date historic preservation came to be understood as environmental in dimension and specifically topographical in practice. Thus, as the role of the Act became increasingly influential in determining the shape of the face of America, historic preservation itself had become a historic phenomenon.

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