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## RESTORATION REPORT ON STATUE OF LIBERTY

During the past 12 months a team of engineers and architects from Paris have been working with preservation professionals from the National Park Service, U.S. Department of the Interior. The purpose of this collaboration has been to evaluate the physical condition of the Statue of Liberty and to make recommendations for repairs or improvements. Careful examination was performed by this team with means causing as little damage as possible to the structure and skin of the Statue. These investigations revealed conditions which have created some reasons for concern.

After nearly one hundred years the Statue sculpted by Frederic Bartholdi shows the stress of her age in the deformation of some of the secondary bracing of her interior structural system. Designed by Gustav Eiffel, a noted nineteenth century French engineer, and constructed of iron rather than steel, these bars have changed shape through fatigue of the iron under a century of continuous force. Fortunately the number of affected bars is not great. More serious is the deterioration of the iron armature. This is a large web-like system of flat bars closely following the interior curvature of the copper skin and giving structural support and rigidity to the softer thin skin. Because of an effect between different metals similar to the process occurring in a battery, the iron bars have begun to deteriorate. This process, called electrolysis, has caused the iron to corrode, especially where it is close to or in contact with the more dominant, or more noble, copper. In some instances the iron bar has lost half of its thickness, in others the expansion of the iron through rusting has caused rivets to be pulled through the skin where the iron bar is held to the skin by a copper saddle.

Before the investigation was begun, serious concern had developed for the condition of the copper skin. Varying in thickness owing to its having been hammered to form its shape, the skin originally seems to have been approximately one-eighth inch thick. Through a natural process copper corrodes to a bluish-green copper-sulfate which forms a protective patina. The cause of concern was the effect of the acid rain and other pollutants on the solvability of the patina. By making the copper-sulfate of this patina more easily washed off by rainwater, the rate of copper loss, and thus the reduction in skin thickness, would increase. However, preliminary examination has indicated that the loss has been less than anticipated, being about 10 to 15 percent.

Planning is now under way for further tests to measure more accurately the copper loss as well as to measure stresses in the Statue's structural system. Methods of replacing the deteriorating iron armature also are being studied, along with developing a means of isolating the new armature from the copper of the skin to prevent further electrolysis. The feasibility of treating the exterior of the skin to retard the loss of copper is being examined in this country and France. Wind and other climatic forces will be monitored also and means of creating better ventilation on the interior are being designed. When all of the data has been collected and the designs are complete, work will begin to give the Statue of Liberty a new lease on life for her centennial birthday present.

July 1, 1982