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A Monumental Improvement

An advanced new lighting system for the Washington Monument greatly improves the Monument's lighting, while decreasing energy use.

Background

The Washington Monument is one of the most prominent symbols in Washington, D.C., a landmark visible day and night from miles around. Standing at a height of 555 feet, the Monument is the tallest structure in Washington, D.C. Made of marble, granite, and sandstone, the gleaming and dignified obelisk serves as a symbol of the Nation's gratitude to George Washington for his contributions to liberty and democracy.[1] Construction of the Monument began in 1848, by the Washington National Monument Society and the U.S. Government[2]. The project was completed on December 6, 1884.[3]

Photo courtesy of Paul Frederickson

An evening view of the Washington Monument.

Lighting designers have always grappled with how to light the slender structure at night because the Monument's tall, thin shape makes it inherently difficult to light. Prior to 2005, traditional lighting approaches and technologies were used with mixed results to illuminate the Monument. The lighting system also included a total of twenty 400-watt fixtures mounted in surface-mounted vaults to illuminate the lowest level of the Monument. Lighting installed after the Monument was restored in 2000, and used twenty-seven 1,000-watt fixtures located in vaults around the edge of the plaza and eight 400-watt lights on poles. As good as this system was at the time, it still had limitations and underperformed, both in terms of lighting and energy use. The lighting on the Monument was uneven, with dark areas, especially at the very top of the obelisk. Meanwhile, only 20 percent of the light hit the Monument, with the rest spilling into the night sky as wasted energy and light pollution.

New and emerging lighting technologies with well-designed fixture optics improve lighting quality of our national monuments, while decreasing energy requirements.

[1] Sharidan Alexander, About.com. "Washington Monument" http://godc.about.com/od/monumentsusgovernment/p/washingtn_mon.htm
[2] John Lockwood. "A Monument Within A Monument." *Washington Post*. July 22, 2007. http://www.washingtonpost.com/wp-dyn/content/article/2007/07/20/AR2007072001811.html
[3] Philip Kennicott. "Bathed In the Right Light There's a Star System That Decides What Does and Doesn't Glow in the Washington Night." *Washington Post*. August 26, 2007. http://www.washingtonpost.com/wp-dyn/content/article/2007/08/24/AR2007082400650.html

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New Lighting Technology

In 2005, Musco Lighting, a company specializing in lighting sports events, took a closer look at the lighting of the Washington Monument. A new system was designed using mirrors to create a bright, narrow ribbon of light. A mirror-like surface inside the fixture directs light into a focused beam 500-feet high and about the same width as the Monument.

Today, using advanced optics, more than 80 percent of the light shines directly on the surface of the Monument. In addition, fewer light fixtures are needed. The 2,000-watt fixtures operate at 1,500-watts. In addition, there are 66 150-watt fixtures mounted in-ground at the base of the Monument to illuminate the lower level. There are only 12 2,000-watt fixtures illuminating the entire Monument—three fixtures on each side (see graphic). Because each fixture provides a highly focused beam, they are now located much further from the Monument. This has led to the elimination of lighting vaults at ground level - a significant improvement because the old fixtures posed a security threat (they can hide people) and attract insects.

The new system is more than twice as bright as the original system. It greatly improves overall lighting uniformity, creating in a smooth wash of light that illuminates even the highest point of the Monument.

Finally, the new lighting system gives the Monument a more three-dimensional appearance by varying the illumination on each face. The brightness ratio on adjacent sides of the Monument creates a visual contrast that is closer to that seen during the daytime. This unique approach makes the transition between surfaces much more apparent, giving the Monument a more vibrant and natural feel.

Conclusions

The lighting system developed for the Washington Monument excels in highlighting one of our Nation's most famous historic icons. Furthermore, this lighting solution for such a tall, slender monument proves that even unique and difficult structures can be effectively and efficiently lit.

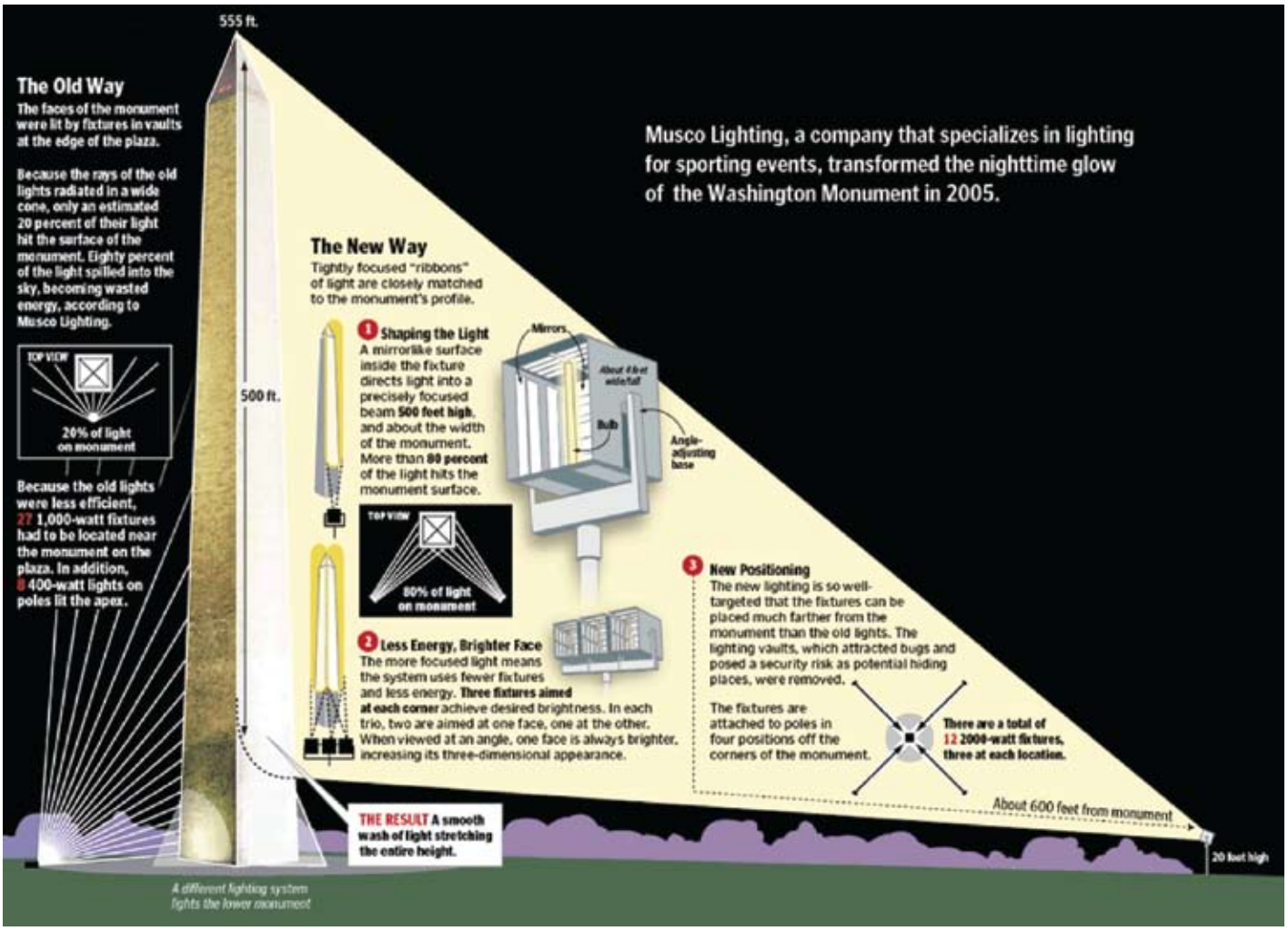
New lighting design for the Washington Monument improved the brightness, uniformity, and energy efficiency, which was lacking in the old lighting (original lighting shown in inset).

Energy Use and Environmental Impacts

While the lighting improved dramatically, the total power used to light the Washington Monument was reduced. Power dropped from 38,200 watts to 27,900 watts, a reduction of 27 percent. The result is an energy reduction of over 50,000 kWh per year, and a reduction of 36 tons per year in CO_2 emissions.

	Old System	New System
Total system wattage	38.2 kW	27.9 kW
Operating hours	14 hours/day	14 hours/day
Energy use per year	195,202 kWh	142,569 kWh
Energy saved per year	n/a	52,633 kWh
CO_2 reduced per year	n/a	36.1 tons

Schematic of the Before and After Washington Monument Lighting System



Graphic courtesy of the *Washington Post*.

NPS Energy Program

The National Park Service (NPS) operates 391 individual park sites throughout the United States. Most sites have facilities which consume energy and water to operate and serve park visitors. The **NPS Green Energy Parks Program** supports the efforts of individual parks to improve the energy and water efficiency of our Nation's National Park system. To accomplish this, NPS is working with DOE's Federal Energy Management Program to provide individual park sites with technical and project financing assistance. For more information on NPS, go to www.nps.gov.

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