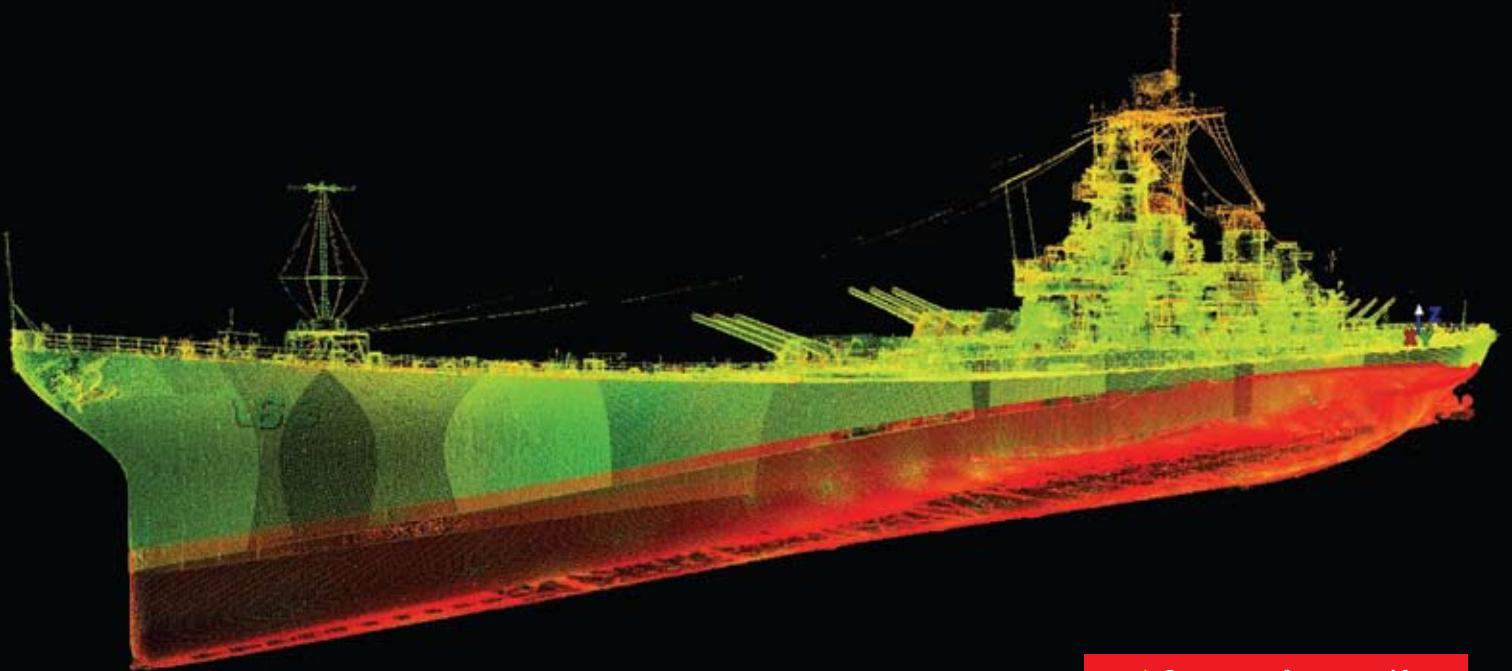


▼ *U.S.S. Missouri ready to sail*



Mustang Helps in Once-in-a-Lifetime Laser Scan of Historic U.S. Battleship



▲ *Laser scan from port side*

The *U.S.S. Missouri* played a prominent role in U.S. naval history for her significant involvement in three wars and for being the historic site of the Empire of Japan's surrender, ending World War II. In early January 2010, Mustang played an instrumental part in a complete laser scanning of the battleship's mammoth hull and topsides as part of a fast-track, once-in-a-lifetime opportunity. This project was the first-ever complete scan of a historic naval vessel.

The *U.S.S. Missouri*, aka 'Big Mo' or 'Mighty Mo', is perhaps the most recognized of all the battleships in the U.S. Navy. An *Iowa*-class vessel, she was the last battleship built by the United States. Commissioned in 1944, she first served in the Pacific campaign, including decisive battles at Iwo Jima, Okinawa and Japan's mainland. Subsequently she played an instrumental role in the Korean War and, after reactivation and refurbishment from the 'Mothball Fleet' of reserve vessels, was engaged once again during Operation Desert Storm in 1991. In her prime, the battleship accommodated more than 2,700 officers and men. Overall, the *Missouri* received 11 battle stars before its decommissioning and permanent retirement in 1995.

Since mid-October 2009, the battleship had been in drydock at the Pearl Harbor (Hawaii) Naval Shipyard for a three-month overhaul to repair softball-sized holes and other corrosion damage to her 13-inch thick steel hull and topsides. As part of the \$18 million refurbishment, she then received a complete new paint job and was due to resume as a national historic site and memorial by the *U.S.S. Missouri* Memorial Association at Pearl Harbor, near the *U.S.S. Arizona* monument.

The association commissioned a complete laser scan of the battleship for historical reference and multiple other uses. Mustang and its laser scanning group manager, David Stevens, were hired for the job. Stevens was one of four scanning experts working for prime contractor Smart MultiMedia to complete the mammoth project. Since scanning could not be done under water or while the ship was in motion, timing of the project's window of opportunity was critical and left no



▲ Signing deck monument



▲ View from bow (note people below)



▲ David Stevens – Mustang's Laser Scanning Group Manager

room for delays or error. After the vessel had been painted and the scaffolding and protective wrapping removed, there remained only three days – January 4 thru 6 – in which the entire battleship’s exterior could be scanned. After that, the *Missouri* was floated out of dry dock and towed into open waters for the one-day shooting for scenes for an upcoming motion picture. She then was returned to her permanent Pearl Harbor berthing site in time for final preparation for her scheduled January 30, 2010 re-opening as a museum.

Mustang’s assignment was the scanning of the top two-thirds of the hull and some of the topsides, both port and starboard.

The *Missouri* is gigantic, measuring more than 880 feet long, 130 wide and 200 feet high. For the work, Stevens used Mustang’s Leica ScanStation II time-of flight scanner to create highly precise, three-dimensional (3D) scans at a $\frac{3}{8}$ -inch grid as required by the project criteria. The scanning camera captured everything in view of a complete 360-degree 3D image, collecting hundreds of thousands of data points each second to create a point cloud that could ultimately be converted into digital imagery. The camera is highly accurate to approximately 300 yards so it could be operated safely from the dock. After scanning from a single reference point, a high definition digital photograph was taken from that location before the camera



▲ U.S.S. Missouri in drydock (view from stern)

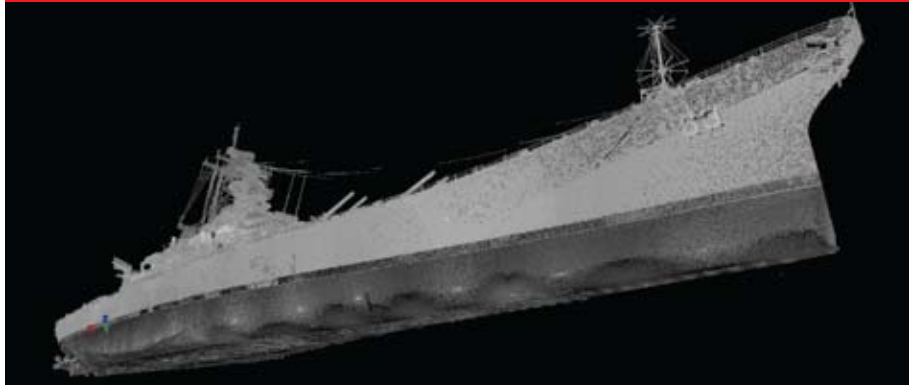
was moved to an adjacent spot. With extensive pre-planning and working 14-hour days from sunup to sundown, Stevens scanned from 19 positions, collecting the data to turn over to Smart MultiMedia for further use. He and the other technicians completed the project in just 3½ days. Normally a project of this size would have taken at least 12 days. Manual surveying by a much larger crew would have taken months and would have been much less accurate than the laser scanning.

The scans will be used to provide animation for the motion picture. They will also be used to compose a ‘fly-through’ of the *Missouri* that can be used as part of a documentary for persons unable to navigate a live tour of the battleship. The information will be used for any future refurbishing needed on the battleship. One unexpected benefit of the scanning was a precise measurement of its teak decks that are badly worn and scarred from service. With the scan data, the foundation will be able to secure exact bids for their replacement

Mustang performed the work to perfection, as it has done with more than 60 assignments on upstream and downstream projects. On those projects, Mustang’s laser scanning team collected the data in the field and transmitted the digital image back to a designer for input into 3D modeling software for designing or redesigning facilities. The outcome is unparalleled accuracy and considerable cost savings to the client. While scanning the *Missouri* was a unique experience for Mustang, it also highlights the capability of Mustang’s laser scanning group and the leading-edge quality of their equipment.



▲ Group shot of scanning crew and support team



▲ Laser scan of bottom from starboard side



▲ Scanning was continuous, dawn ‘til dark



▲ Portside Ortho