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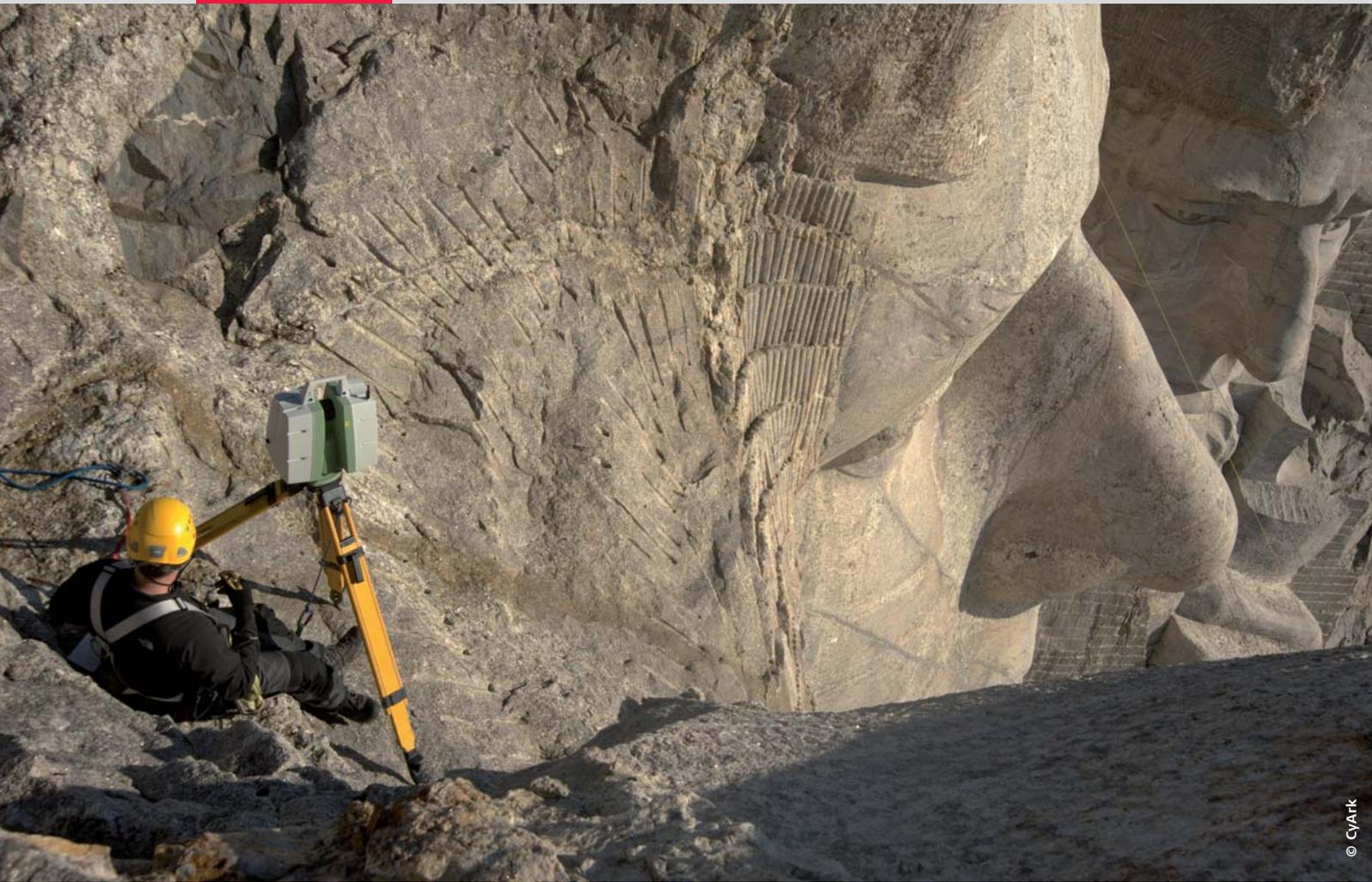
Scanning on Washington's Shoulder

by Elizabeth Lee

3D laser scanning has already changed the fields of surveying, engineering, construction, and forensics. Now, 3D laser scanning is changing the fields of education, cultural tourism, and cultural heritage preservation and management. With help and support from Scotland and Leica Geosystems, the non-profit organization CyArk carried out the first comprehensive documentation survey of the Mt. Rushmore National Memorial.

In May 2010, teams from CyArk and the Scottish Center for Digital Documentation and Visualisation (CDDV), with additional support from Leica Geosystems, deployed an array of Leica Geosystems laser scanners to digitally capture the famous Mt. Rushmore National Memorial. The memorial is a spectacular sculpture carved high into the granite face of Mount Rushmore in South Dakota (USA). It features four 18m sculptures of former US presidents George Washington, Thomas Jefferson, Theodore Roosevelt, and Abraham Lincoln, or as many surveyors know them, "three surveyors and some other guy (Roosevelt)."





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The memorial park site covers more than 5 km² and is 1,745m above sea level.

The data capture is the first phase of a five-year project between CyArk and the U.S. National Park Service (NPS) to provide both engineering-grade data for tasks such as rock-block monitoring, analysis, and site resource management, as well as a base data set to create virtual tourism and educational materials for public outreach and data dissemination.

The project deployed up to three teams, operating five scanners at once, in various locations throughout the park and on the mountain. Complete coverage of the mountain sculpture was a necessity for the engineering and interpretive needs of the park; therefore it was critical that all surfaces be scanned at a high level of accuracy and resolution.

Four Leica Geosystems scanner models were used: Leica ScanStation 2, Leica HDS6000, Leica HDS6100, and the new Leica ScanStation C10. Each scanner model was strategically deployed within the site to utilize its unique strengths; for example the ScanStation 2

with its long-range capabilities was used along the base of the mountain. The speed and dense data capture abilities of the HDS6000 and HDS6100 were used to capture all the details in the canyon behind the sculpture and throughout the park grounds. Because of its blend of range and speed the ScanStation C10 was used as the workhorse atop the mountain for wide-view scans of the sculpture.

The new compact design of the ScanStation C10 and its on-board controls were essential for using the scanner in precarious positions on the mountain. In one setup location, the NPS ropes team and scan team lead, Douglas Pritchard of CDDV, rappelled from the top of the monument down to George Washington's shoulder with the scanner. With the scanner secured on the president's shoulder and the scan settings selected, Pritchard and the ropes team then rappelled off the side of the shoulder to avoid obstructing the scan. Scans captured from these positions were critical to the success of the project.

To ensure accuracy and complete coverage of the mountain, a data command center was set up on

The CyArk 500 and the Scottish 10

The non-profit organization CyArk was created to apply the advantages of 3D laser scanning or High-Definition Surveying™ (HDS™) to the field of digital heritage preservation. Rather than transporting engineers to a digital plant, CyArk virtually transports students and web travelers inside Native American ruins at Mesa Verde National Park (USA) or to the top of the Leaning Tower of Pisa in Italy. Instead of capturing a crime scene for analysis, CyArk works to capture cultural heritage sites around the world to create a shareable, 3D digital record of humanity's tangible history.

CyArk was created shortly after the Taliban's dramatic destruction of the Bamiyan Buddhas in Afghanistan. Often credited as the Father of Laser Scanning, Ben Kacyra knew the power of laser scanning to capture the built environment. Envisioning the creation of a cyber archive for humanity's cultural wonders of

the world, Kacyra (who also founded Cyra Technologies – now the laser scanning business unit of Leica Geosystems), founded CyArk in 2003.

To date, CyArk has utilized HDS technologies to capture, process, archive, and disseminate digital data for over 30 heritage sites around the world. This progress became the catalyst for launching the "CyArk 500 Challenge", a challenge to digitally preserve 500 important heritage sites. Upon hearing about CyArk 500, the Scottish Minister of Culture, Michael Russell, was impelled to get involved. Already using HDS technology within Scotland and eager to contribute to CyArk's global mission, the visionary Scottish Minister made the generous commitment of the "Scottish 10", the contribution of 10 projects to the CyArk 500. These projects consist of the five UNESCO World Heritage Sites within Scotland and five international projects.

site and all team members were equipped with two-way radio systems. CyArk's Justin Barton used Leica's Cyclone software to do daily registrations of the data. This allowed the scan-team members on the mountain or on the visitor's trail to radio the command center for up-to-date information on the scans and instant feedback on proposed scanner setup locations.



The project was a tremendous success, resulting in the first comprehensive survey documentation of Mt. Rushmore. The capture of this American icon complete, CyArk is now at work creating the engineering and educational deliverables to supplement the laser scan data in the CyArk archive. There, a digital 3D Mt. Rushmore will sit alongside world treasures from around the globe as the CyArk team takes on future challenges to bring state-of-the-art survey and documentation techniques to other heritage sites for the benefit of future generations. ■

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