RECLAMATION
Managing Water in the West

U.S. Department of the Interior
Bureau of Reclamation

Western Water and Power Solution Bulletin

Research and Development Office — Denver, Colorado

Bulletin No. 41
January 2011

LiDAR Assists in Archaeological Site Preservation and Protection

A tool for improved analysis and preservation of archaeological features that saves time and money

What Is The Problem?

Locating, documenting, analyzing, and protecting archaeological sites, petroglyphs, pictographs, and other cultural features have long been a challenge for archaeologists and resource managers. Monthly, semi-annual, or annual surveys, usually in remote locations, are necessary for archaeological features in one location or over vast areas employing such traditional approaches as on-the-ground surveys, grid drawings, and photographs that are labor intensive, time consuming, and that do not capture all aspects of the objects and sites. Geographic Information Systems (GIS), another approach, uses layers of spatial information to display patterns at a large scale with information already available and, generally, does not provide new information on a finer scale. Scale issues also are experienced with aerial photography.

What Is The Solution?

LiDAR (light detection and ranging), a relatively new technology, has had very limited archaeological and historic preservation applications during the past decade, most notably analyzing Stonehenge in England and restoring fresco paintings in European churches. With advances in LiDAR technology and reduced costs, a variety of archaeological features now can be more efficiently surveyed in concentrated or larger areas. LiDAR also provides visual information in addition to geospatial accuracy.

A high-speed pulsed laser beam is sent from the LiDAR device measuring up to 50,000 points per second at "survey grade" accuracy. The high-resolution sets of measurement points then are processed to depict accurate three-dimensional (3-D) images. This automated process is much faster than previous methods. Using LiDAR to collect archaeological data not only saves time and money compared to traditional methods, but the data can be captured to submillimeter accuracy depending on the instrument used. Savings are estimated to be 50 to 70 percent compared with traditional methods.

Traditional methods of creating grids, renderings, and photographs of numerous inscriptions, artifacts, and sites miss the fine detail that a 3-D laser image captures. LiDAR digitally represents all angles of a subject with artificial lighting that produces 3-D images, allowing archaeologists and land managers to capture features previously unseen and view changes sooner for more efficient site restoration and protection. Another capability of some LiDAR units is the ability, under certain conditions, to penetrate through openings in vegetation and use algorithms to depict ground surface features.

Who Can Benefit?

Archaeologists, tribes, land resource managers, and others seeking to preserve or reveal new archaeolocial sites can benefit from incorporating LiDAR into their field work.

Where Have We Applied This Solution?

Reclamation used terrestrial LiDAR for petroglyph panels in the Cedar Bluff Reservoir area in Kansas during three field seasons (2008-2010) to record changes caused by vandalism and erosion, examining inscriptions with a Leica High Definition Scanning ScanStation 2 unit to create 3-D images that allowed archaeologists to pinpoint panels needing treatment. A field laptop operated the ScanStation 2, capable of measuring 50,000 points per second and controls were plotted with Global Positioning System for placement into a state coordinate system. A FugroViewer was used to view LiDAR data collected by Leica software. In 2010, a mobile version of the ScanStation 2, the hand-held Z scanner, recorded data at the submillimeter level.

Examining panels using a Leica ScanStation 2.

Future Development Plans

Airborne LiDAR is being tested in the American Falls Archaeological District in Idaho.

More Information

Using terrestrial LiDAR to conduct archaeological surveys is a relatively new development. Information about 3-D LiDAR archaeological research in the American Falls Archaeological District can be found at: http://www.usbr.gov/research/science-and-tech/projects/detail.cfm?id=9541.

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Collaborators

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