

Canyons of the Ancients LIDAR Scanning Project Report

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June 25, 2013

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General Site Procedures

Onsite Description of Technical Processes:

Using LiDAR to digitally scan a site and/or structure is different for every project. Depending on the desired outcomes and deliverables expected the strategies involved can vary widely. For the most part though, the equipment we bring is similar. Besides the Leica made Scan Station 2, we use a PC laptop to control the scanner, a standard Ethernet cable to connect the two, a number of HDS targets on tripods, two large batteries to power the scanner, a tribrach, Nodal Ninja, Digital SLR camera, and a separate, heavy tripod that supports the 40 pound, fully robotic scanner. We also bring a gas-powered generator with us to most sites, as they tend to be remote. The generator powers the laptop and charges the batteries used for the scanner.



Leica Scan Station 2 at Parallel Wall House

Once a thorough site inspection has been completed so that scan locations and target locations have been identified the scanner is set up in its first location. These scan locations are determined based on efficient data collection and wide coverage of the site and or structure that is being documented. Once the scanner is ready it is connected to the PC laptop via the Ethernet cable. We use a software program called Cyclone (made by Leica) to connect the scanner to the laptop. After the appropriate settings are established the scanner can now be controlled by the laptop. The scanner is equipped with a digital camera (low quality) inside and has the capability of taking a nearly 360-degree image from the perspective of the scanner. This allows us to see what the scanner sees from the laptop. We can now see what the scanner sees and can begin to select what to scan through this digital image provided to us through the Cyclone software interface.



Aerial view of scan data at Parallel Wall House

Once we can see this preview image the scanning can begin. Depending on how much and at what point densities we are scanning a scan can take anytime between 15 minutes and several hours to complete. The scanning itself is not the only thing going on at each scan location. Within each scan we are also acquiring HDS (High Definition Surveying) targets. These are very precise points in space that allow us to tell the scanner where it was in space in relationship to the other scan locations. This is important for post-processing efforts once data collection is complete. The process telling the computer where each scan location was in relation to the other scan locations is called registration. This is when we tie all the scans together to create a completed 3D model.

Once scanning and target acquisition is completed we use the Digital SLR camera to collect better image information than the scanner can. We take the time to collect HDR (High Dynamic Range) photography at each location. HDR allows us to capture high quality images that give us more information than standard photography. We also collect RAW images for greatest quality and color range. We collect a

365-degree sphere of images that we later stitch together and texture map onto the point cloud data for a more photo-realistic 3D model.

Once scanning and HDR photograph is complete at each location the process of moving to the next location must be completed. During the process of moving all the equipment related to the scanning process it is critical to make sure that they stay out of the way of the scans. We often are shifting around the generator, battery boxes, scanner boxes, etc. to ensure we are only capturing the site and its structures. As we move equipment around we are also being very cautious not to shift targets. These HDS targets are so accurate that even an accidental touch can shift the target out of position giving you errors in the post-processing effort. The target locations are also very specific so they can be seen from multiple scan locations. At each location the scanner is disconnected, powered down and moved with care.



Scanner and equipment at Saddlehorn Hamlet

Procedures and Scanning Effort Details for McElmo Flume

On Site Process:

The University of Colorado Denver scanned 2 sites in the Canyons of the Ancients National Monument – Parallel Wall House and Saddlehorn Hamlet using a Leica Scan Station 2 Scanner. Starting on August 17th 2010 Mike Nulty and Justin Barton (CyArk) arrived on site at Parallel Wall house at approximately 11am and began scanning at the first location by 12pm. In total, eight different scan locations were acquired on site, and of those locations three consisted of 360 degree scans to acquire surrounding context of the surrounding area. The remaining five scans consisted of detailed window scans of the structure and other important features. In addition to scanning, eight panoramic images were also captured at each location to be used for photo texturing during post processing. Six HDS targets were used throughout the site as control points that would later tie all eight scan locations together. Two to four targets were acquired at each location. The final scan was started at about 12pm the next day (8-18-10). The scan team packed up that afternoon to travel to the second site – Saddlehorn Hamlet.

The scan team arrived on site at Saddlehorn Hamlet at approximately 5:30pm on 8-18-10. A scan was attempted that evening but rain and wind made it impossible to scan. Scanning was restarted the next morning at approximately 7am. In total, 5 different scan locations were used to record the two room structure and surrounding context. Five HDR, panoramic images were collected at each location. Eight HDS targets were used throughout the site as control points that were used to tie all five scan locations together. With so many targets collected we were able to use an automated process for registering all scan worlds together. The scan team finished up at about Noon that day (8-19-10).

Initial Post-Processing:

Later that year post processing of the two sites began. All panoramic images were processed and eventually applied to each scan location making the data look more photo realistic. All scan locations were registered together using a combination of target and feature registration with a Mean Absolute Error (MAE) of only .002 m.

Deliverable Processing:

Leica's Cyclone software was used to create scaled and ortho-rectified views of the scan data. CloudWorx software was then used to bring this 2D scan data into AutoCAD. The scan data was then traced in AutoCAD to create a scaled and accurate drawing of the structures and surrounding context. These hardline drawings were then printed on Mylar. The final step was to use hand stippling and rendering to give the digitally created drawings a hand drawn finish and look. Final drawings included site plans, plans, elevations and sections.

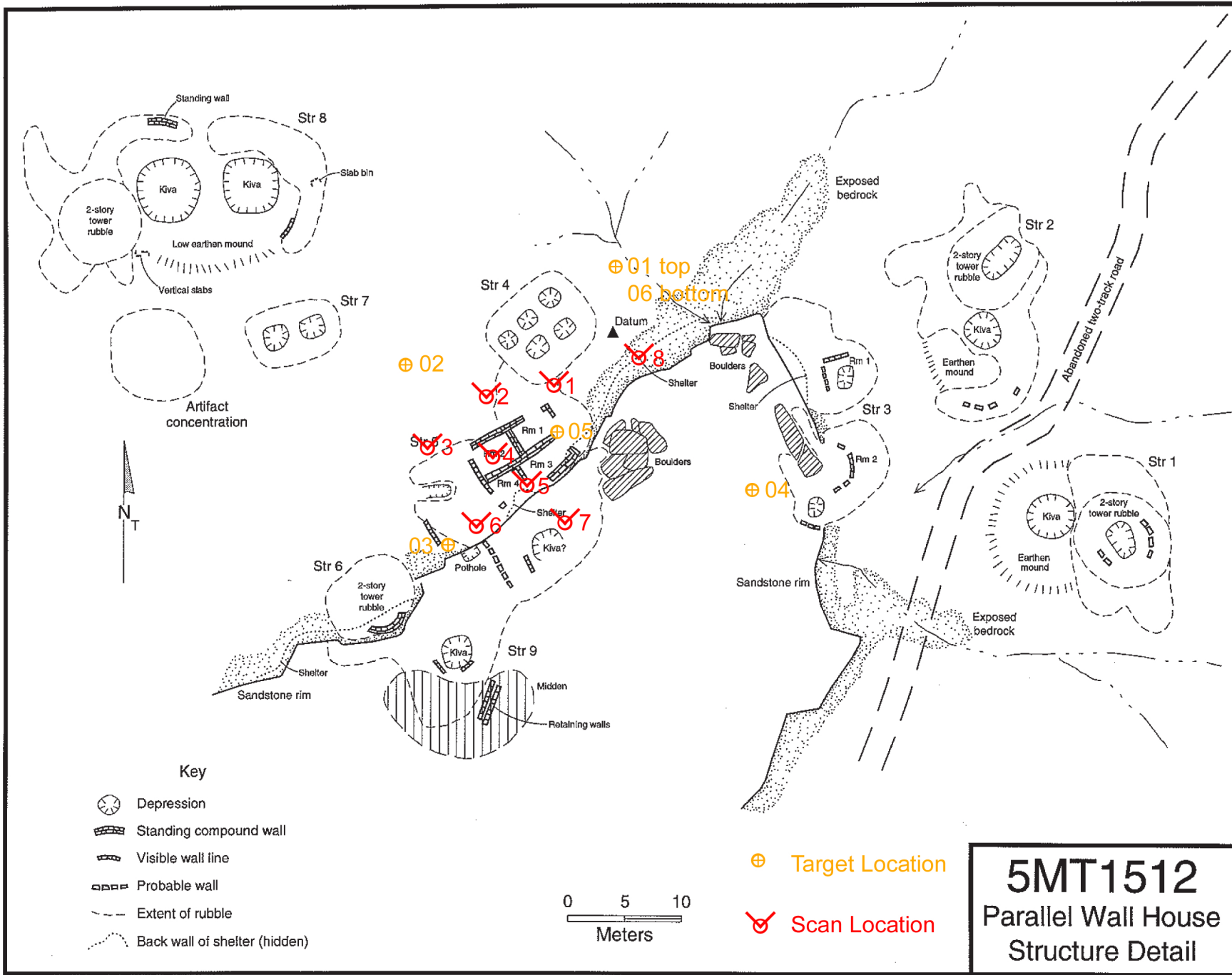
Site Photos

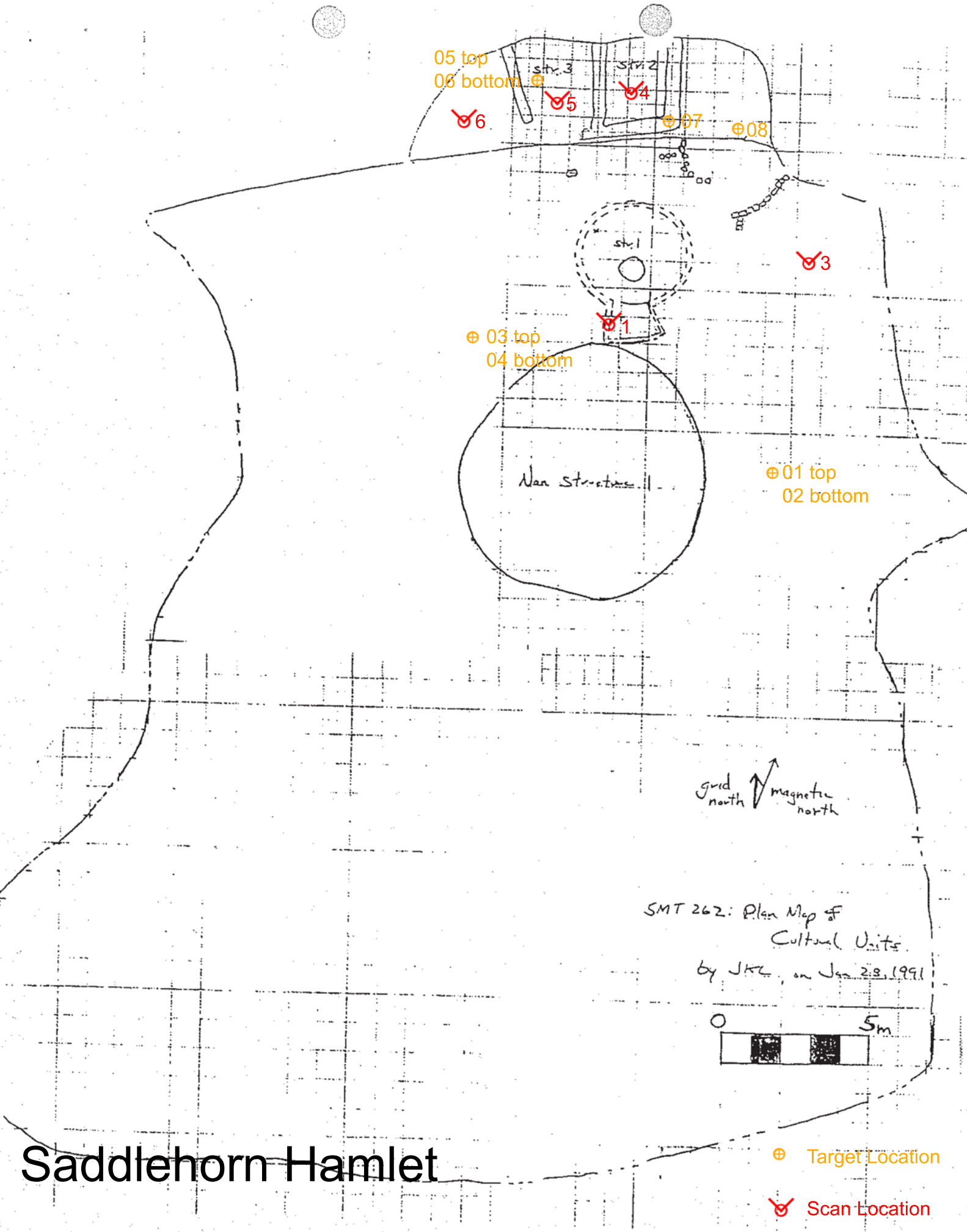


Parallel Wall House being scanned by Leica Scan Station 2



Field Notes:





Saddlehorn Hamlet

- ⊕ Target Location
- ✓ Scan Location

