CoPR - Center of Preservation Research
College of Architecture and Planning
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Project Report

LiDAR Scanning of Independence Rock

Project Team

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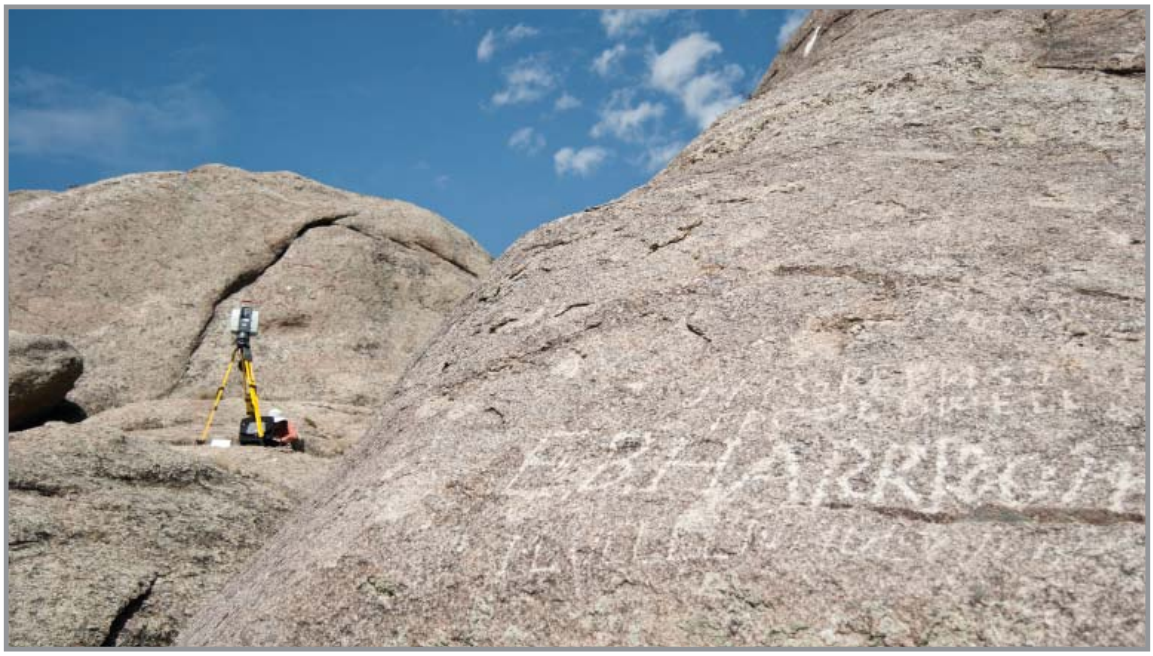

Content

November 1, 2012

[1] Project Overview

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Project Location

Independence Rock
60 mi. SW of Casper on WYO 220
Natrona County, WY

Project Dates

On-Site Scanning:	July 30, 2012 - August 3, 2012
Post-Processing:	September 2012
Deliverable-Processing:	October 2012
CyArk Public Launch:	December 2012

Proposed Project Scope

- 3 Days on-site scanning
- Scan Locations to capture Full Site
- 40 (aprox) HDR Panoramas
- 10-20 Inscriptions captured with Photogrammetry
- Capture 25 HDR Photographs
- 4 2D ortho-rectified Point Cloud Drawings
- One 2D Site Plan
- 5 Perspective Views of 3D Scan Data
- One Animation Visualization of 3D data

Actual Project Outcome

- 5 Days on-site scanning
- 38 Scan Locations
- 38 HDR Panoramic Images captured
- Photogrammetry of 34 Inscriptions
- 25 HDR Photographs were captured
- 6 Point Cloud Drawings were created
- One 2D Site Plan was created
- 27 Perspective Views captured
- 4 Animations created

[2] Site Evaluation and Assessment

On June 29th, 2012 CoPR documentation coordinator, Mike Nulty, traveled to Independence Rock to scope out the site. When he arrived he was shown around the site by Richard Anderson, the Independence Rock State Park Superintendent. Richard took Mike to the cave, where he showed him the only tar names that still exist on the rock. To Richard and other state park employees, these names were of high importance, and they believed the cave and the names in the cave should be a high priority during the documentation of the rock. Richard also took Mike to many other historical names of significance, many of which are threatened by lichen, natural elements, and modern graffiti. These names were also considered to be of high priority during documentation of the rock.

During the site visit, Mike was also able to get an idea of the immense size of the site. Stretching almost 2,000 feet in length, and peaking more than 125 feet in height, the rock would be no simple or easy subject to document using LiDAR laser scanning technology. Possibly one of the trickiest parts would be scanning the entire rock, while at the same time documenting many of the small names etched into the rock, all within five days. Therefore, following the site visit, Mike began developing a scan plan that would effectively and timely capture the entire site within five days. The CoPR team also had numerous conversations with partner CyArk, discussing both the scan plan and the areas of highest priority while documenting the rock. During these conversations it was decided that in order to capture the detail of the inscriptions and the immense size of the rock, photogrammetry as well as laser scanning would be used for this project. Photogrammetry would be used to capture, in detail, 10-20 historically significant inscriptions, while laser scanning would be used to capture the entire rock, at 5-7 cm point density, and its surrounding context.

Another planning effort by the CoPR team was the research of historic names on the rock. Through conversations with the National Park Service and Independence Rock Park Staff, the time period between 1850-1853, was identified as significant. This time period was chosen because during these years the greatest number of people were traveling along the Oregon trail. Following this decision, CoPR research assistant Julia Ausloos spent a few days researching names of significance, and where they might be on the rock if they still existed. With help from the book *"In Tar and Paint and Stone - The Inscriptions At Independence Rock and Devil's Gate"* by Levida Hileman, Julia created a list of more than 30 historically significant names, all ranging around or during the established period of significance. On the list a description of each name and its importance was given, as well as where it can be located on the rock. This list was then sent to Richard Anderson, the park superintendent, with hopes that while on site he or other park employees would be able to locate and show the CoPR team specifically where these names are on the rock.

Independence Rock is an important piece of our nation's historic fabric, and because of this it sees heavy pedestrian traffic from tourism in the summer months. However, due to modern inscription graffiti, lichen growing on the rock, and natural elements, many of the oldest and most significant names on the rock are beginning to disappear. In order for future generations to enjoy and learn from Independence Rock as many do today, we must document the rock, preserving it so future generations can see what we see today.

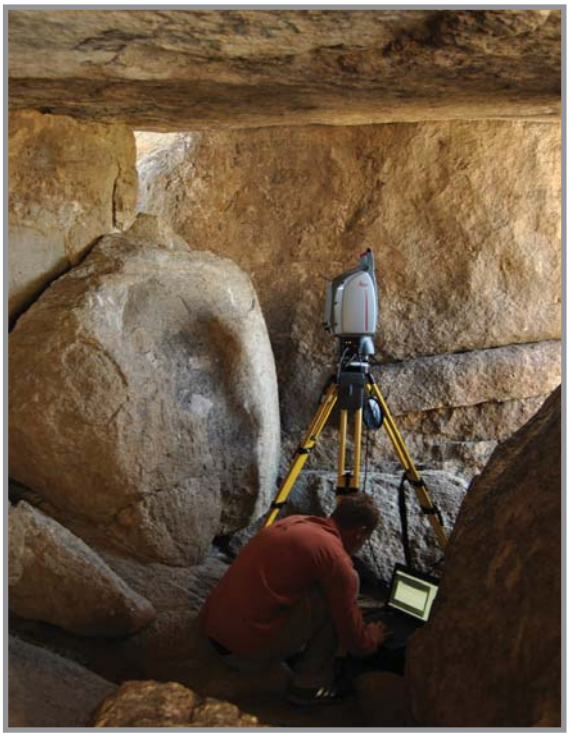
[3] Data Gathering and General Site Procedures

On-site 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.

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 control the scanner with the laptop. After the appropriate settings are established the scanner begin operation. 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.

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.



Mike Nulty scanning the cave at Independence Rock

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.

View of Historic Names in the Independence Rock Cave via Intensity and RGB Values of the processed scan data

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Procedures and Scanning Effort Details

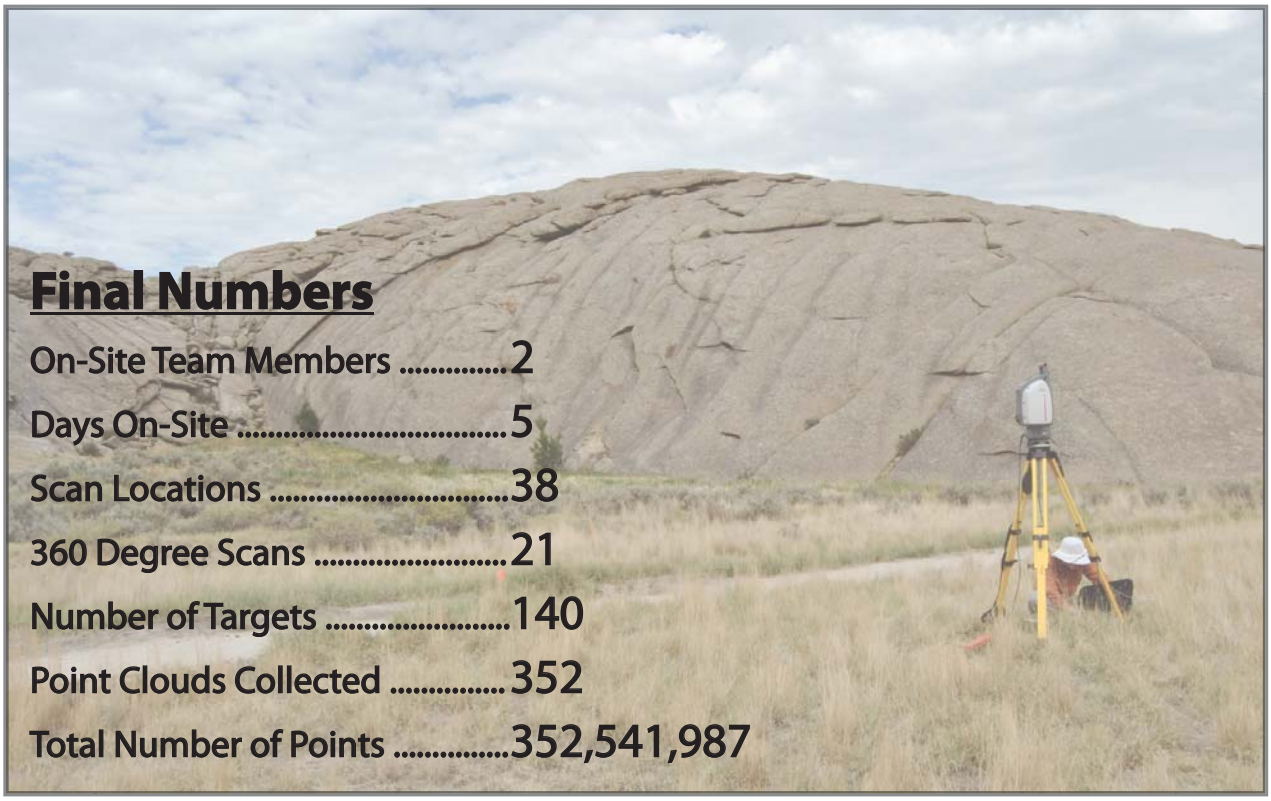
The University of Colorado Denver scanned Independence Rock using a Leica Scan Station 2 Scanner from Monday, July 30th through Friday, August 3rd 2012. CoPR documentation coordinator, Mike Nulty, and CoPR research assistant, Julia Ausloos, arrived at Independence Rock on Monday and began scanning by 11:00am. Seven scan locations were captured the first day, with one scan location rescanned due to high winds knocking targets over. On day two, Mike and Julia captured twelve scan locations, and four of them were 360 degree context scans. On day three, the CoPR team experienced high pedestrian traffic on the top of the rock, delaying them about one to two hours. They finished the day with just ten scan locations, however were still on track with their schedule. On day four weather complications arose; wind had kicked up about halfway through the day causing almost all targets to blow over and prohibiting the scanner from booting up. The wind had persisted throughout the rest of the day, leaving the CoPR team with only five scan locations on the day. On the fifth and final day, the CoPR team started an hour earlier than the previous days, in hopes to avoid more wind issues. Because all the targets blew over at the last location the previous day, the CoPR team had to start their day scanning in the same location they ended at in the previous day. They were able to get about three scans in before the wind picked up again, but with persistent efforts of shielding the scanner from the wind, the CoPR team was able to finish the remaining scans, leaving them at five for the day, and 38 locations total.

The CoPR team used a systematic approach in setting up either five or ten targets at each scan location. The careful placement of targets at each location allowed for the scan data to be tied together using mostly automated registration, and very little feature registration. In order to achieve this, five targets, two twin poles and a single swivel target, were set up at the beginning of each scan; these targets were acquired first. After the first five targets were acquired, they were picked up and relocated on the other side of the scanner, in the direction the team was moving around the rock. When the scanner completed its window or 360 degree scan of the rock, the other five recently set up targets, were acquired. After all ten targets were acquired, scanning at that location was complete and the scanner could be disconnected and moved to the next location. The only times feature registration would be needed was at the end and beginning of each day. Targets were not able to be left up over night because of pedestrian traffic and wind, therefore at the end of each day the CoPR team made sure to fine scan particular features and landmarks to be sure they could also be fine scanned during the first scan of the following day.

Mike Nulty operating scanner at the top of Independence Rock

Scanning a site as large as Independence rock was a challenging task requiring careful planning and coordination. Despite the few complications, including large quantities of pedestrian traffic and extremely high winds, CoPR was still able to digitally document the entire rock and surrounding context on schedule. In addittion to laser scanning, the two person team also documented the site using photogrammetry technology and HDR photography. Both the photogrammetry data and HDR images were collected throughout the five days on site while scanning was taking place. The 360 degree scans, and some longer window scans, require longer portions of time for the scanner to collect the data, sometimes 30-45 minutes. During this down time, the CoPR team carried out these other documentation practices. They captured the images needed to create photogrammetry models for more than 34 inscriptions and inscription panels, and collected images with five different exposures in 25 locations to create digital HDR photographs of the site and context.

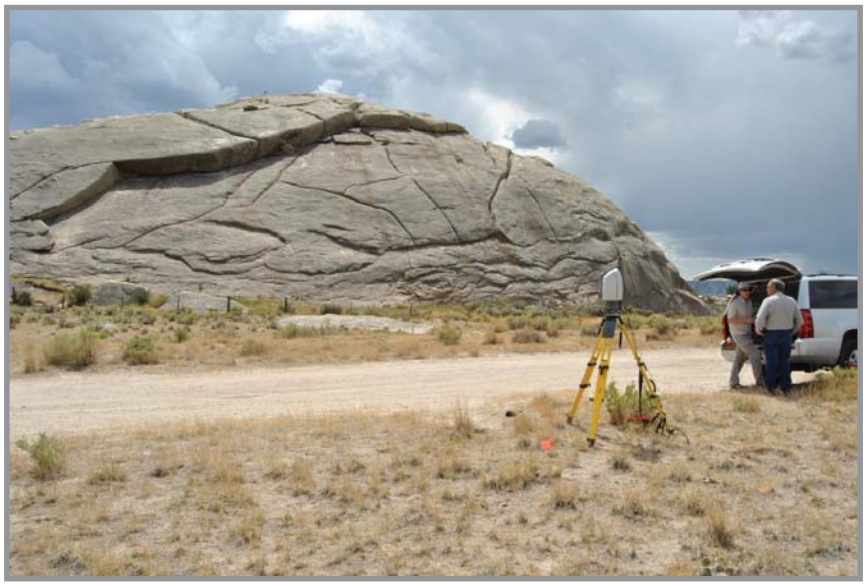
In the end, with laser scanning technology, CoPR acquired a total of 38 different scan locations, and 21 of those locations consisted of 360 degree scans. At each of the 38 locations panoramic images were also captured to be used for photo texturing during post-processing. A total of 140 HDS targets were used throughout the five days of scanning, helping a lot in the post-processing efforts. A scan location took anywhere from 6 minutes to about 45 minutes, depending on location and scan density desired. The ultimate goal was to capture 5-7cm point density of the larger rock, 10cm density of the surrounding context, and 5mm density of twenty selected inscriptions. Besides some shaddowing that occured on top of the rock, CoPR was able to achieve these goals in their five days of scanning.



Site Photos

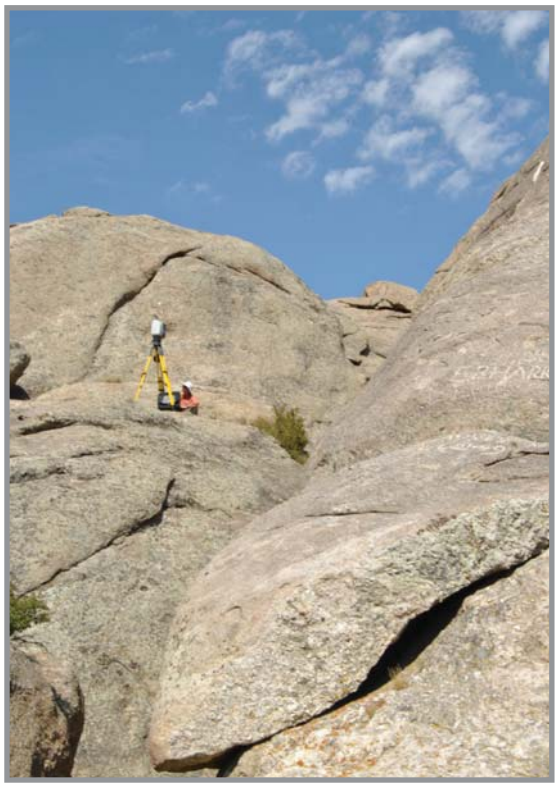
Mike Nulty scanning the Southwest side of Independence Rock

Mike Nulty running the scanner from an ATV provided by state park employees



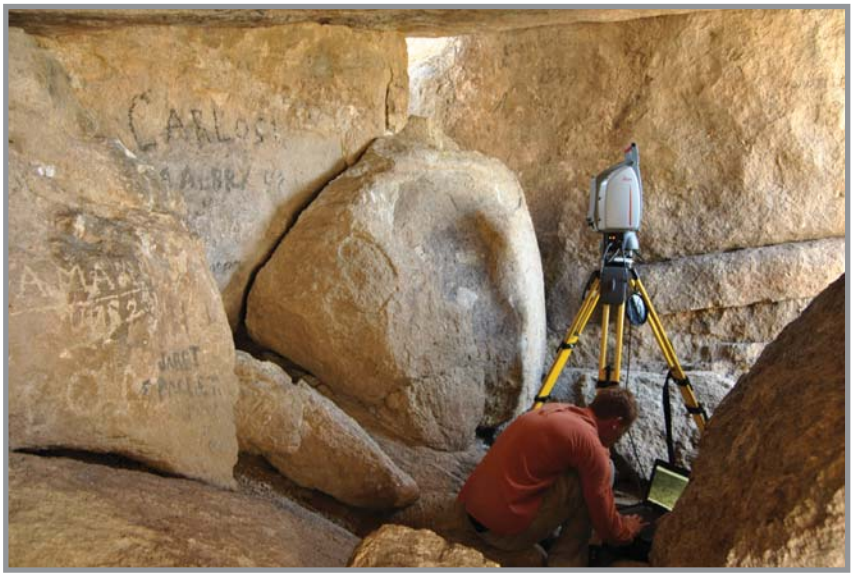
Mike Nulty discussing scanning process with Park Superintendent Richard Anderson

Site Photos



Mike Nulty with scanner on Independence Rock

Scanner on top of Independence Rock with view of Piaya Lake in background

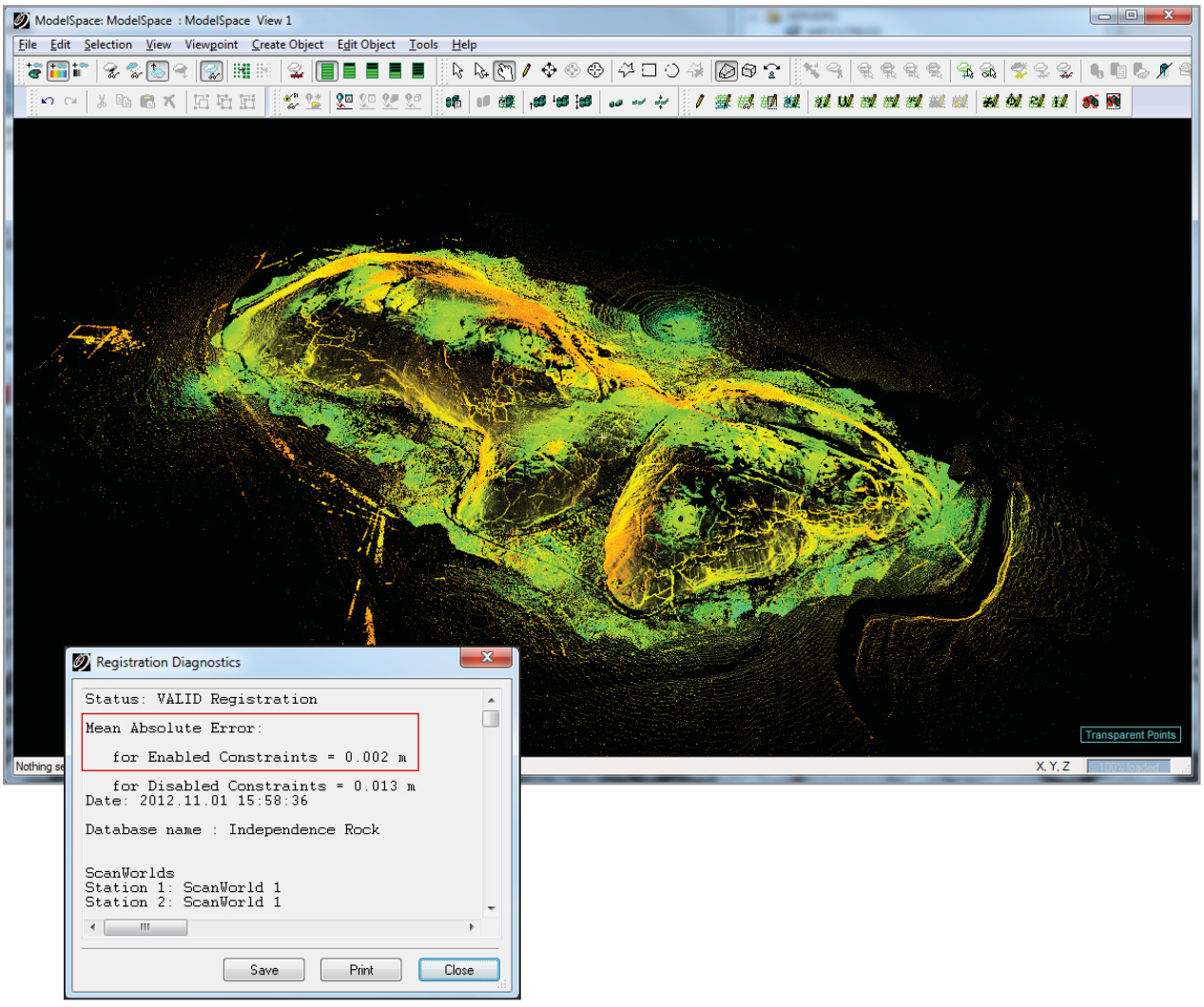


Mike Nulty documenting inscriptions inside the cave at Independence Rock

[4] Data Management

Initial Post-Processing

Towards the middle of August initial post processing of Independence Rock began. All 38 panoramic images were processed using PTGui software. The panoramic images were then used to photo texture each scan location making the data look more photo-realistic. After photo-texturing, all 38 scan locations were registered together using mostly target registration, and feature registering when necessary. The Mean Absolute Error (MAE) of the registered data was only .002 m. (See image below) This exceeds CoPR's standard, which is to have a MAE no greater than .005 m.

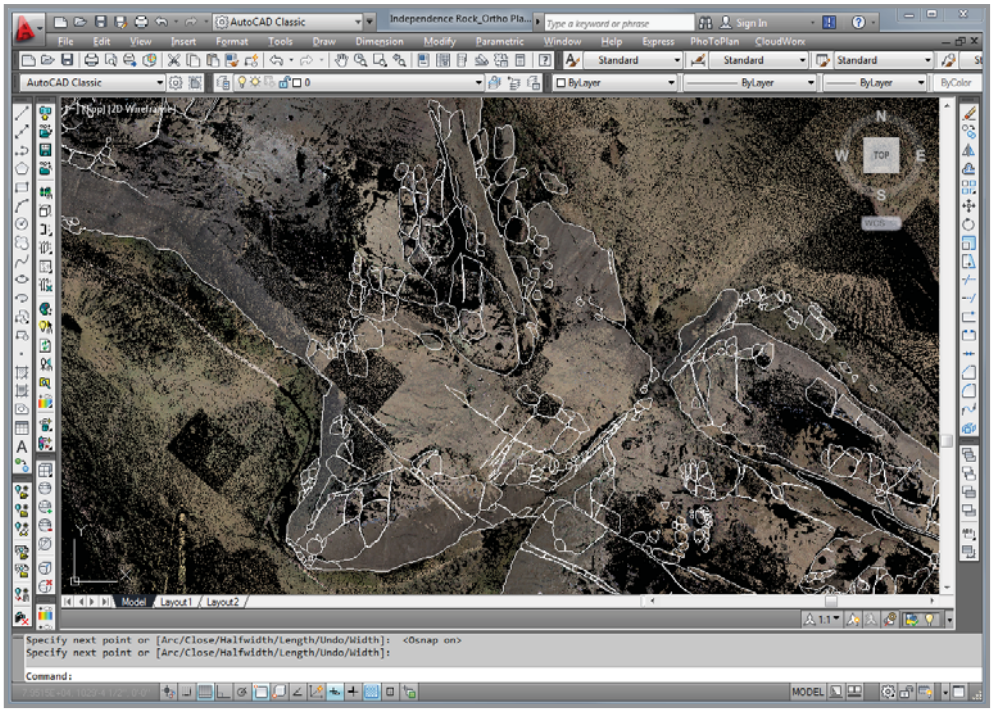


Deliverable Processing

Deliverable processing for Independence Rock began in early October. The first deliverables created were the HDR Panorama QuickTime videos. These were created from the same panorama data captured for photo-texturing of the scan data. The videos were created using the program Pano2QTVR. The purpose of these QuickTime videos is to allow for a virtual tour like experience at each scan location. Three different QTVR movie file sizes were saved for each scan location to provide flexibility in how these virtual tours can be disseminated.

The rest of the deliverables were created using the program PoinTools and/or AutoCAD. During the initial post-processing phase the registered point cloud data was exported to a .PTX format so the scan data could be imported into PoinTools. PoinTools provides better rendering capabilities of the scan data, and offers higher quality visualizations of the point clouds within the scan data. Therefore, an additional 13 Scan Shots were created using PoinTools (some scan shots were created during initial post-processing using Cyclone), and a number of ortho-rectified scaled images. The ortho-rectified scaled images were then imported into AutoCAD and used to create a 2D Site plan (see image below) and 2D ortho-rectified point cloud drawings. The last deliverables created using PoinTools were animation visualizations of the 3D scan data. Fly-through paths were created within the scan data in PoinTools, and then the paths were exported either as an .AVI video file or as .JPG images which were then merged into a video using Windows Live Movie Maker.

In addition to the laser scanning deliverables, CoPR also captured and created HDR photographs and photogrammetry images to create 3D models of individual inscriptions or inscription panels. The images captured in the field to create the photogrammetry models were given to CyArk, where they will ultimately processes the images and create the 3D models. The images collected to create the HDR photographs were processed at CoPR using the program Photoshop. The raw images of the five different exposures were loaded into Photoshop, where they were then stitched together in the program. The 25 HDR digital photographs were saved both as .JPG and .TIFF files.



Screen shot of 2D Site Plan being created in AutoCAD

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Archiving

Full copies of raw and processed data will exist in several places and media. UCD will have a copy of the data backed up on an external hard drive as well as on a local computer. A copy of the data will eventually be housed on DVDs located in a different geographic location from the hard drives as extra protection against loss. The data was also deliverd to CyArk for their records, and for them to upload onto their website for public access. UCD is not contracted to store or backup the data for any amount of time.

Issues of data storage and archiving are complex. Throughout all industries change to data and how it is managed occurs as fast as the technologies that create it. This makes planning for the future of data management very difficult because it is so difficult to know what the data landscape will look like. Not only can we not provide long term solutions (more than 30 years) based on current available medias and strategies but understanding how changes in the future will alter and affect current data are impossible to outline. A clear example of this is how we deal with floppy disks now – we can't.

1. The University is not in a position to archive data for long periods of time.
2. CoPR is responsible for data until it is handed over to client/partner.
3. CoPR maintains a 1 year and 5 year archiving and storage strategies but they are not fool-proof back-up strategies.
4. Data collected and managed by CoPR is stored on a remote server for the first year after collection. A copy of the data is also stored on a local computer and an external harddrive. After one year most data is copied onto a DVD and stored off site. The reliability of data stored on DVD media is variable.
5. CoPR will maintain the data as best as it can for research and academic purposes but should not be relied on as an ultimate backup.
6. CoPR can offer solutions from other providers for more permanent data

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[5] Data Representation

The doocumentation of Independence Rock was an important attempt at preserving many of the historic inscriptions on the rock dating back to the 1800s, when many Americans were traveling West along the Oregon Trail. Many of these historic inscriptions are today endangered by the graffiti of modern inscriptions and lichen growing on the rock. Therefore, the documentation of Independence Rock, through LiDAR 3D laser scanning, Photogrammetry and Photography, was an attampt at preserving these endangered names for future generations. The hope is that there will now be a record of what exists at the current time so our future generations can at least see what we see today.

For this project alone, a number of deliverables were created as an initial representation of the scan data, including HDR panoramic images turned into QuickTime videos, photorealistic and scan intensity-value scan shots, ortho-rectified point cloud drawings, and digital fly-through videos. In partnership with CyArk, these deliverables will be loaded on a website, making all the deliverables available to the public.

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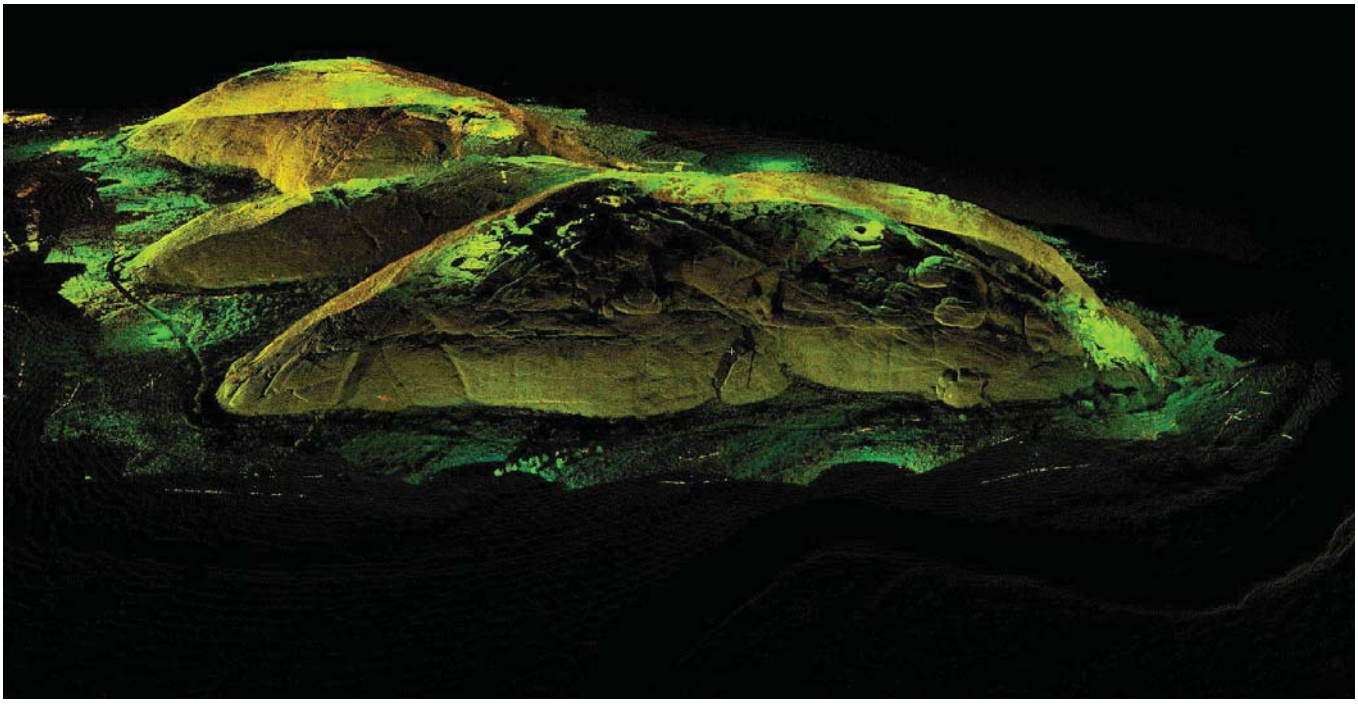
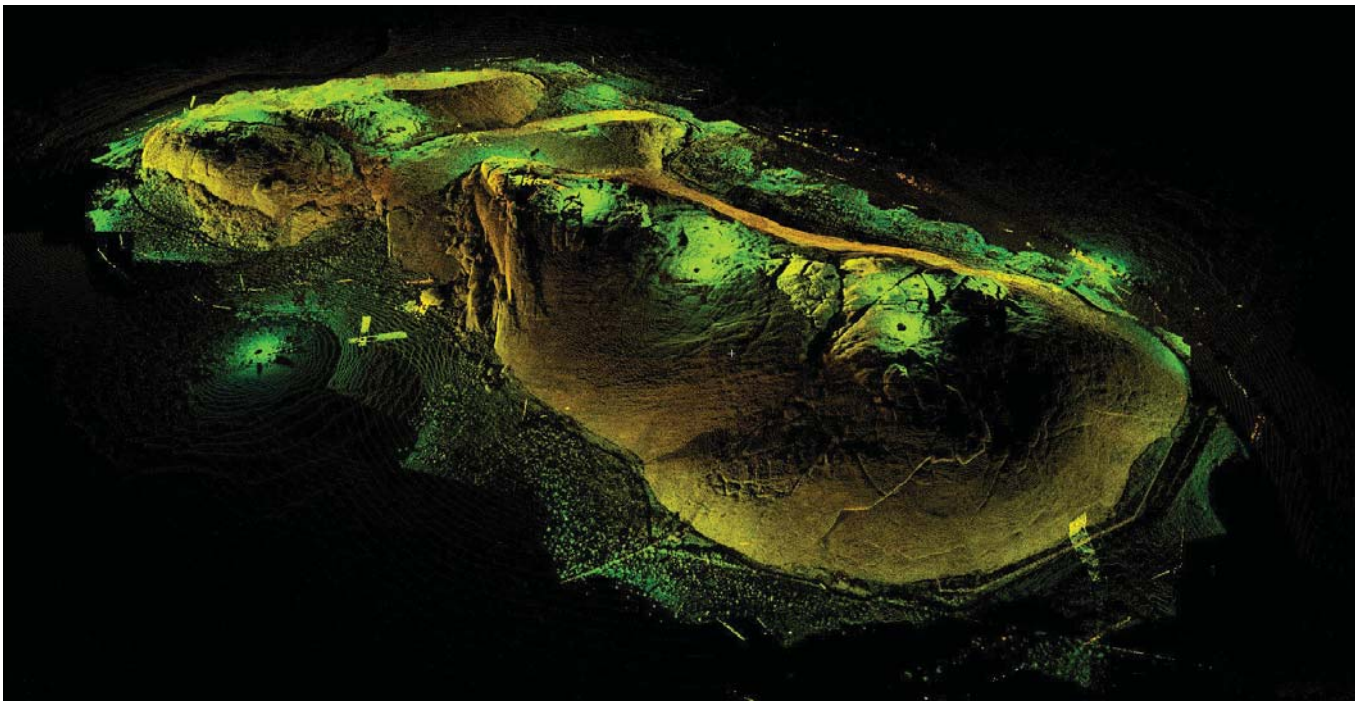
[6] Scan Shots

Aerial view of Independence Rock scan data with intensity-values



Southern birds-eye view of Independence Rock scan data

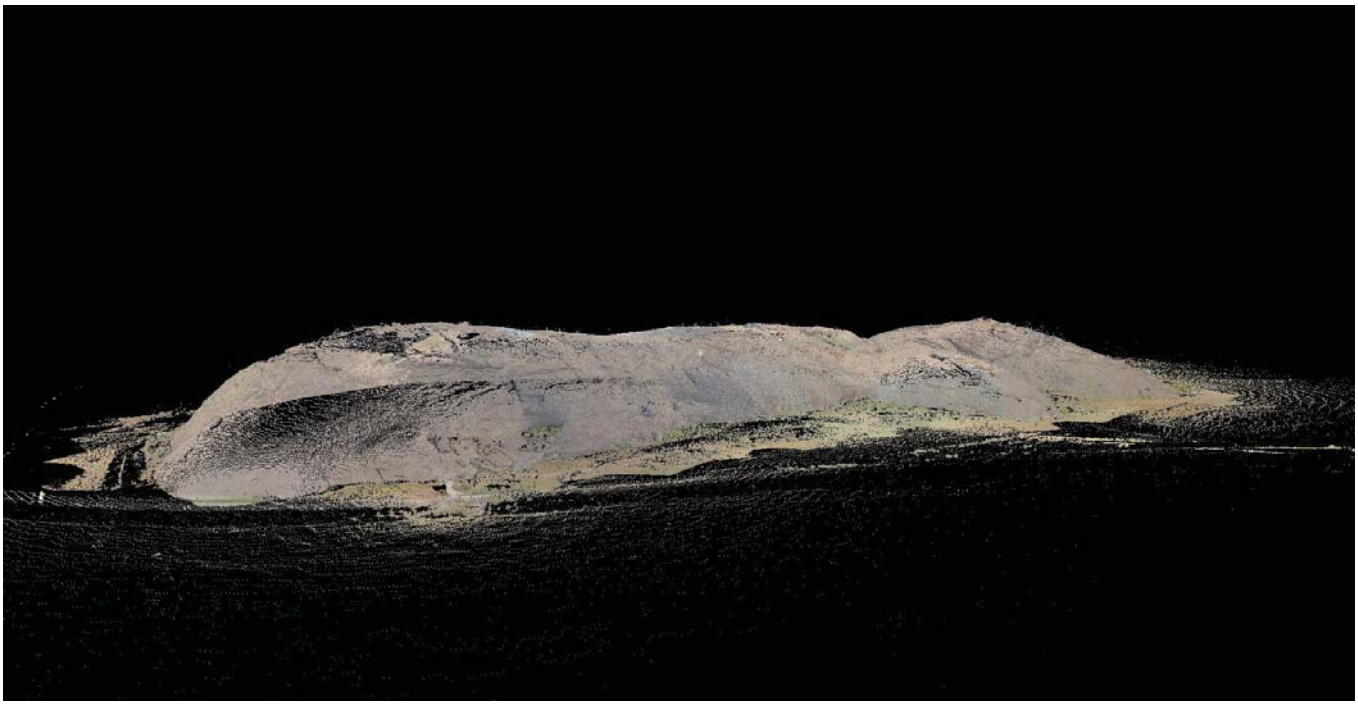


Northern birds-eye view of Independence Rock scan data

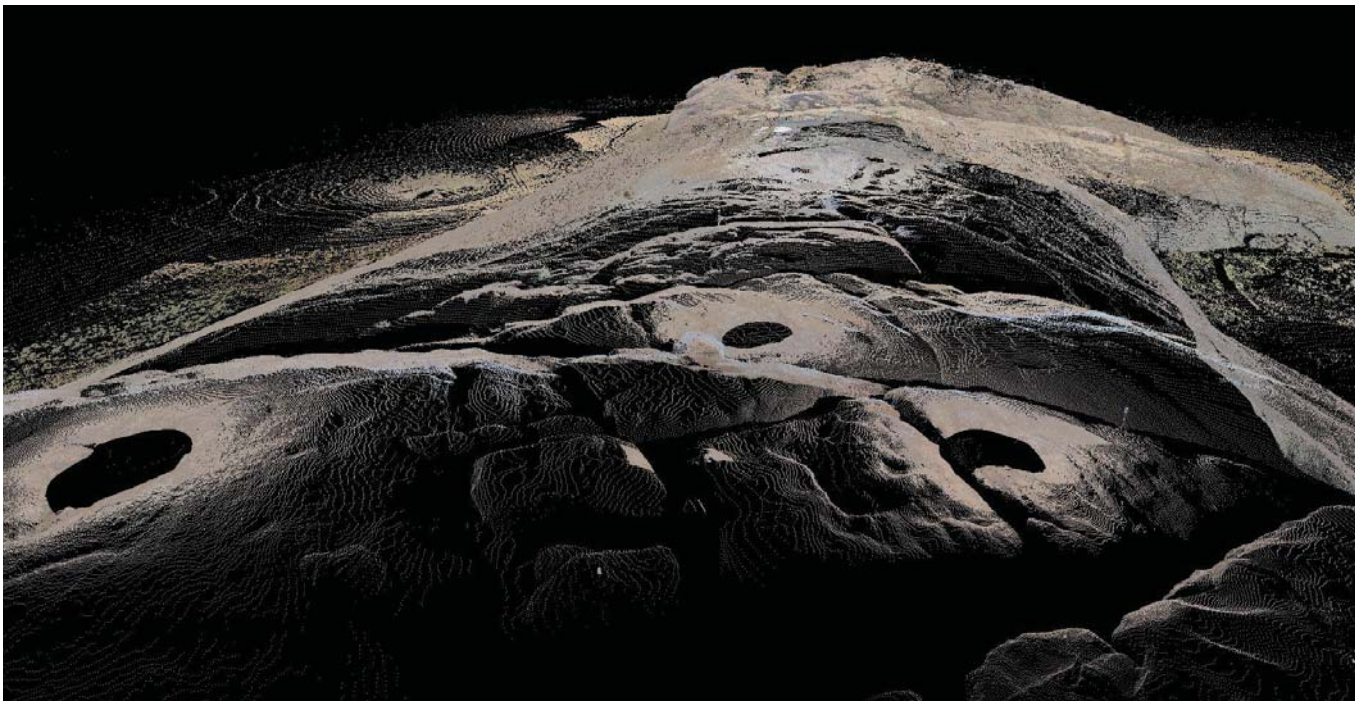
View of historic inscriptions near the Independence Rock cave

Intensity-value view of the historic name *D. Holaday, July 6, 1853* in the cave at Independence Rock


Photo-textured view of the historic name *Chamberlain, July 19, 1849* in the cave at Independence Rock



Northwest birds-eye view of photo-textured scan data of Independence Rock



View of photo-textured scan data from the top of Independence Rock

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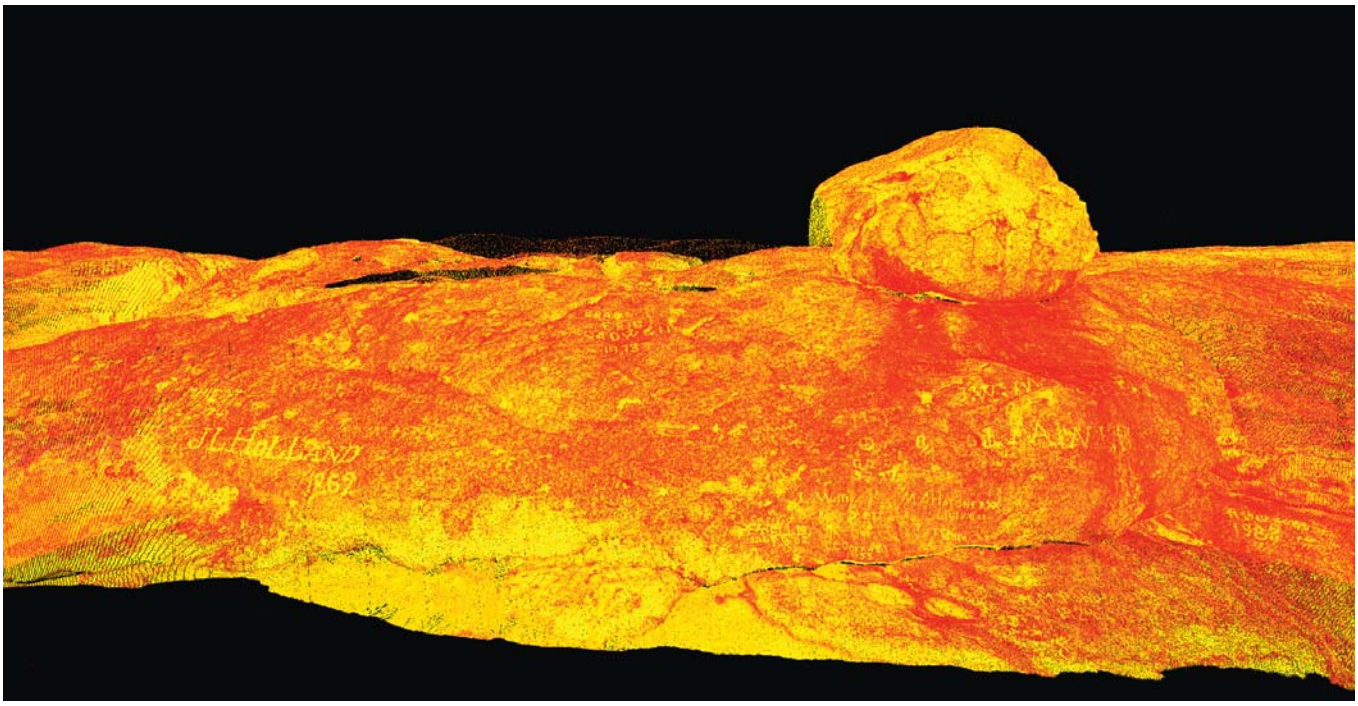
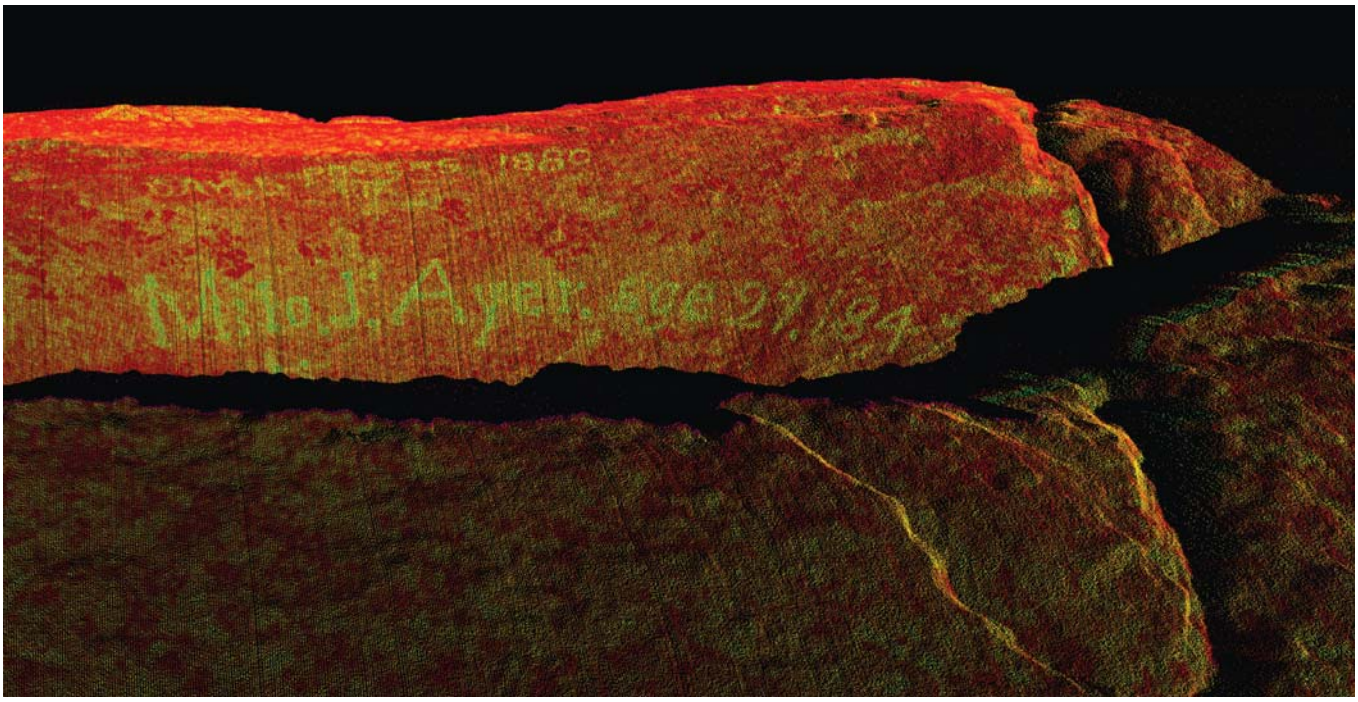
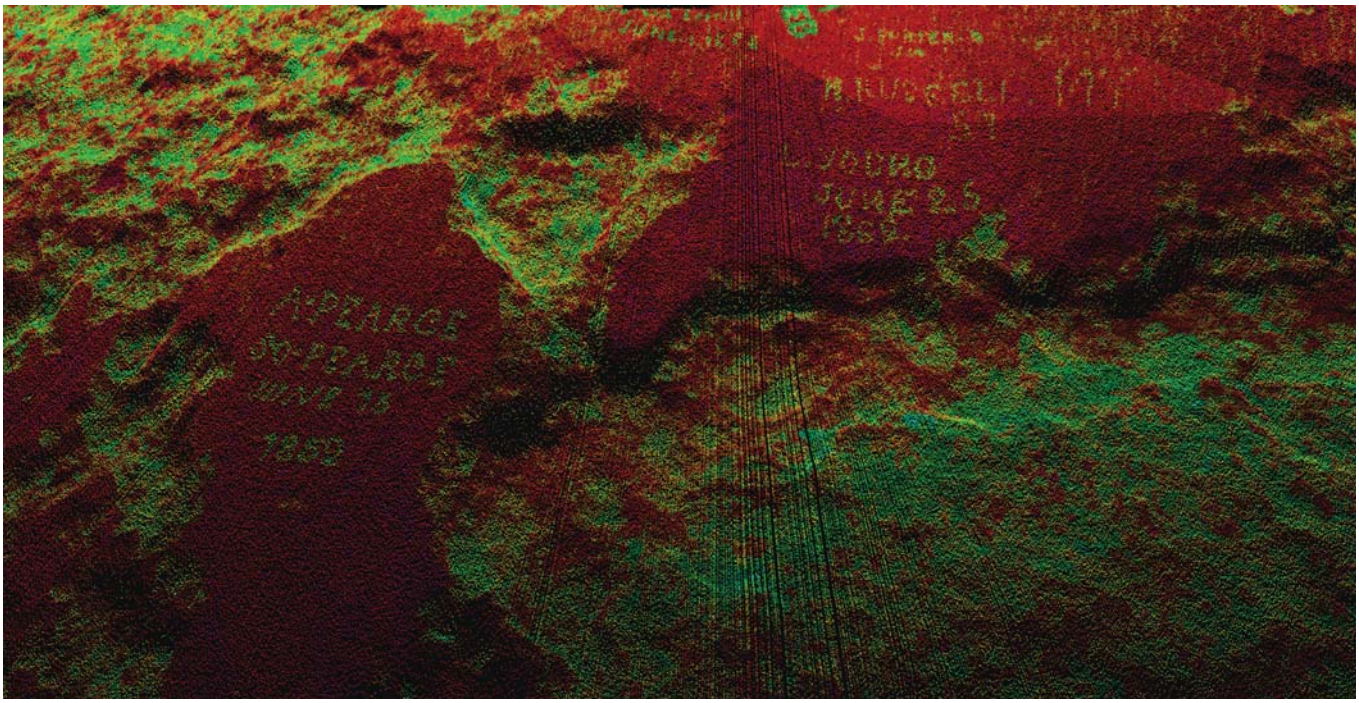


Intensity-value view of historic inscriptions on the top of Independence Rock

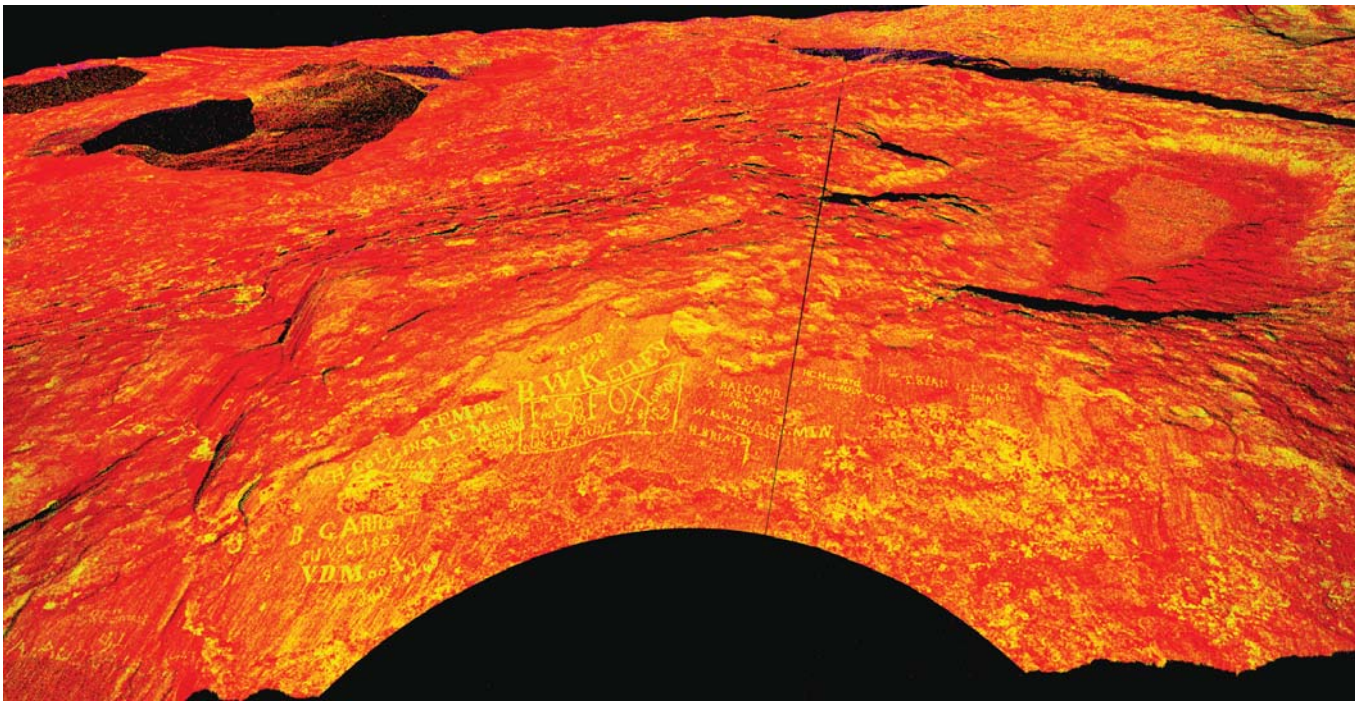
Photo-textured view of historic inscriptions on the top of Independence Rock



View of the historic inscription *Milo J. Ayer. age 29. 1849* on top of Independence Rock



View of historic inscriptions on the top of Independence Rock



Intensity-value view of a panel with historic inscriptions on the middle-top of Independence Rock

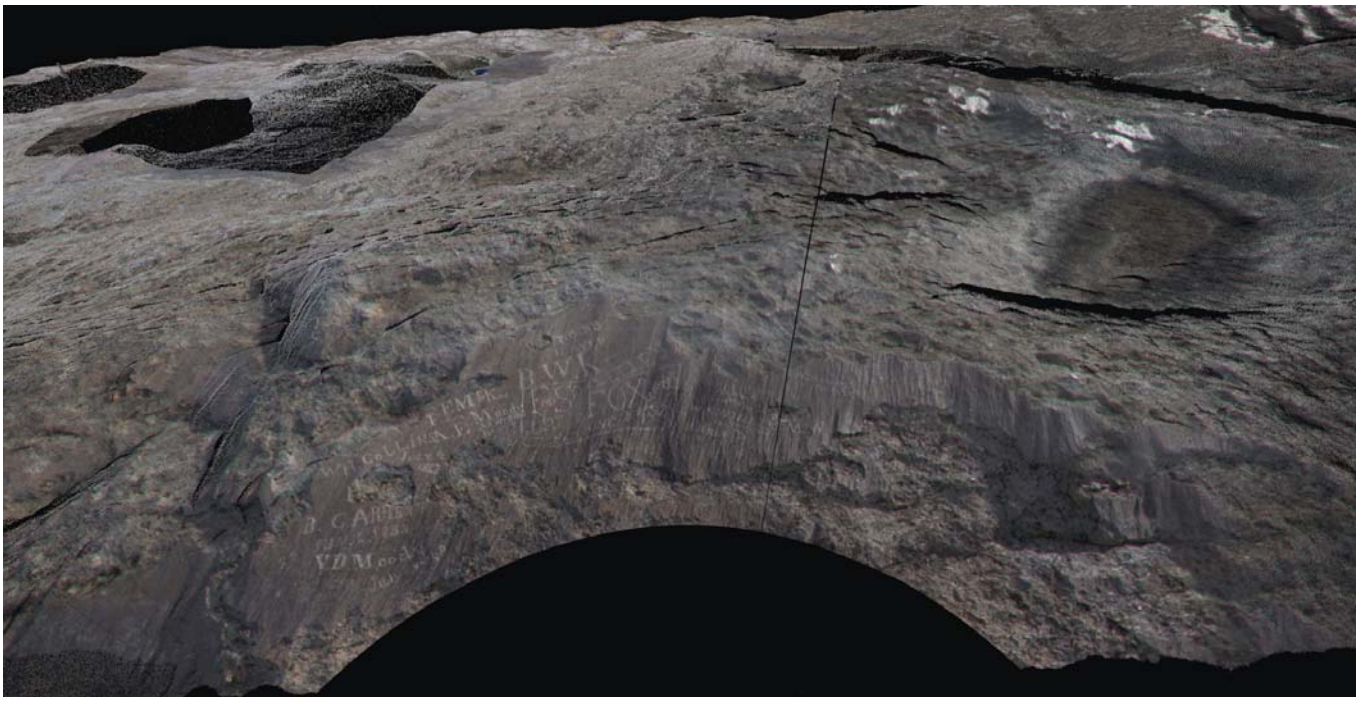
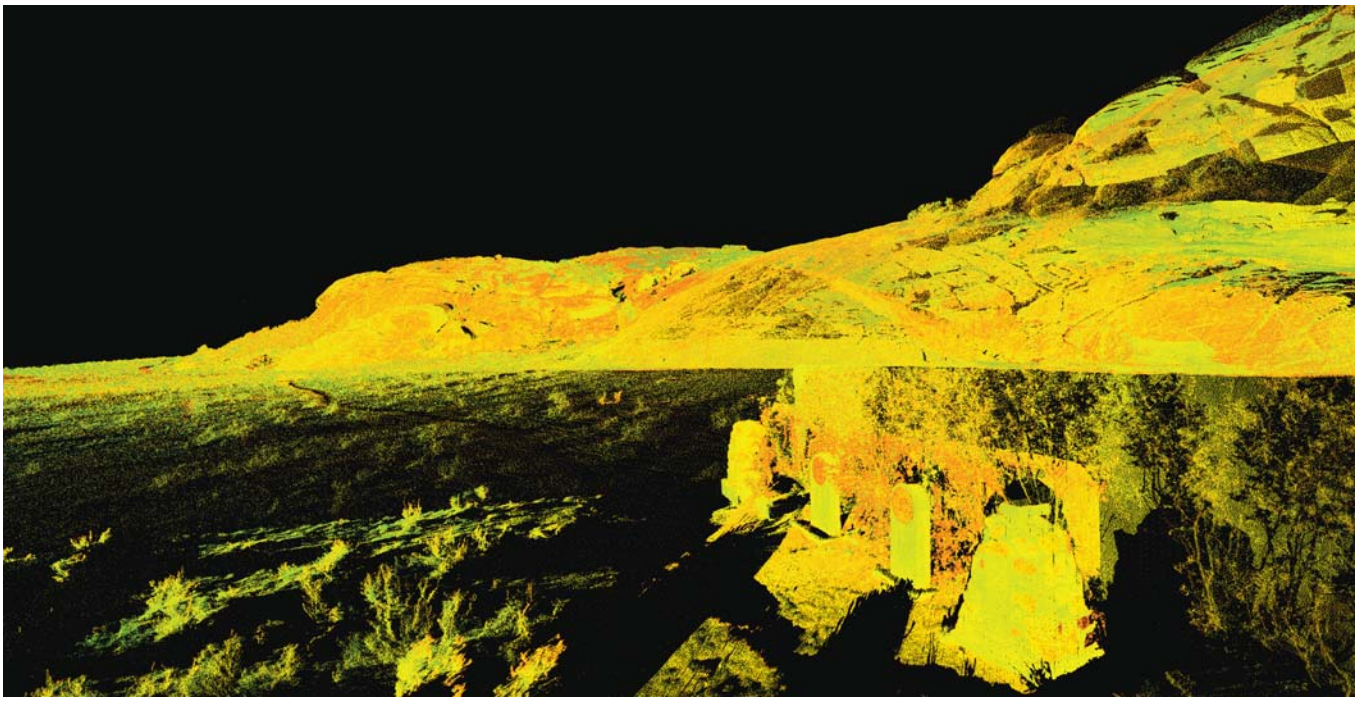


Photo-textured view of a panel with historic inscriptions on the middle-top of Independence Rock

Northwest perspective view of Independence Rock and the path that meanders around the rock



Northeast perspective view of Independence Rock with monuments in the foreground

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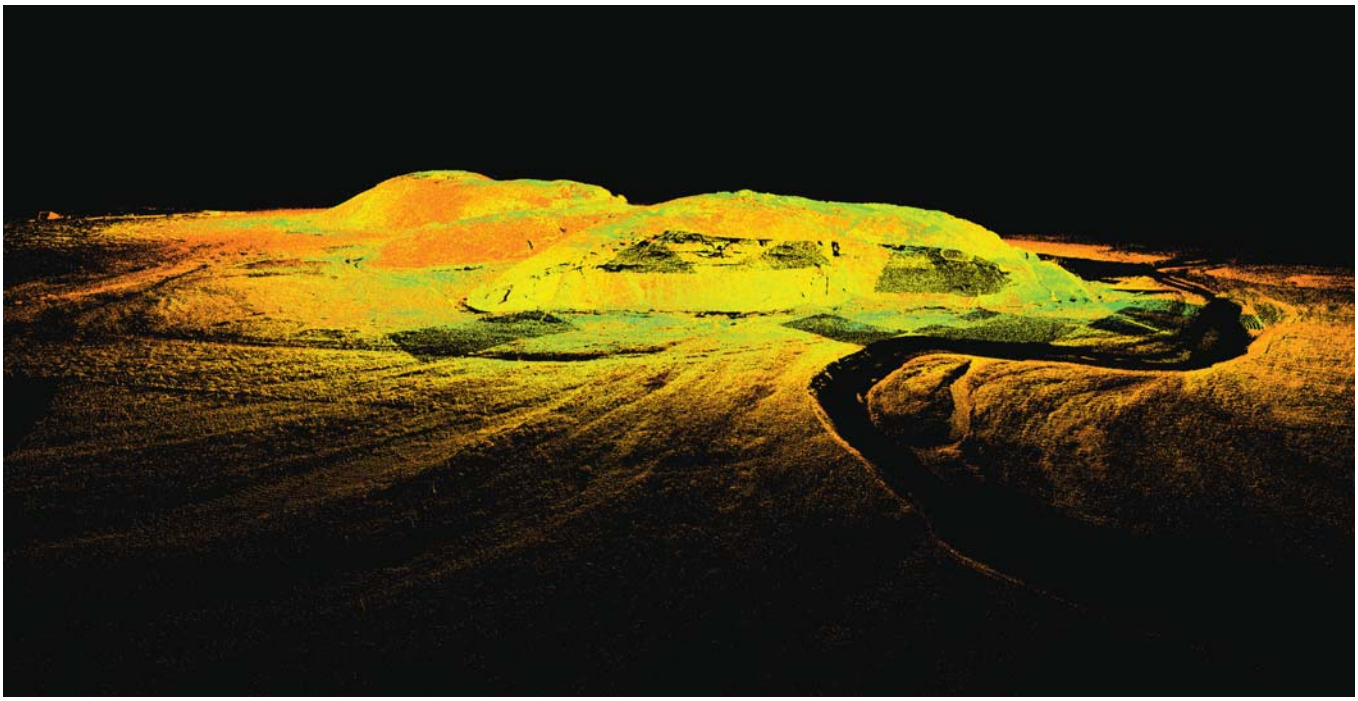
Southern view of Independence Rock and the Sweetwater river



Intensity-value view from the South of Independence Rock and the Sweetwater River

Photo-textured view of the inside of the cave at Independence Rock

Intensity-Value view of the inside of the cave at Independence Rock

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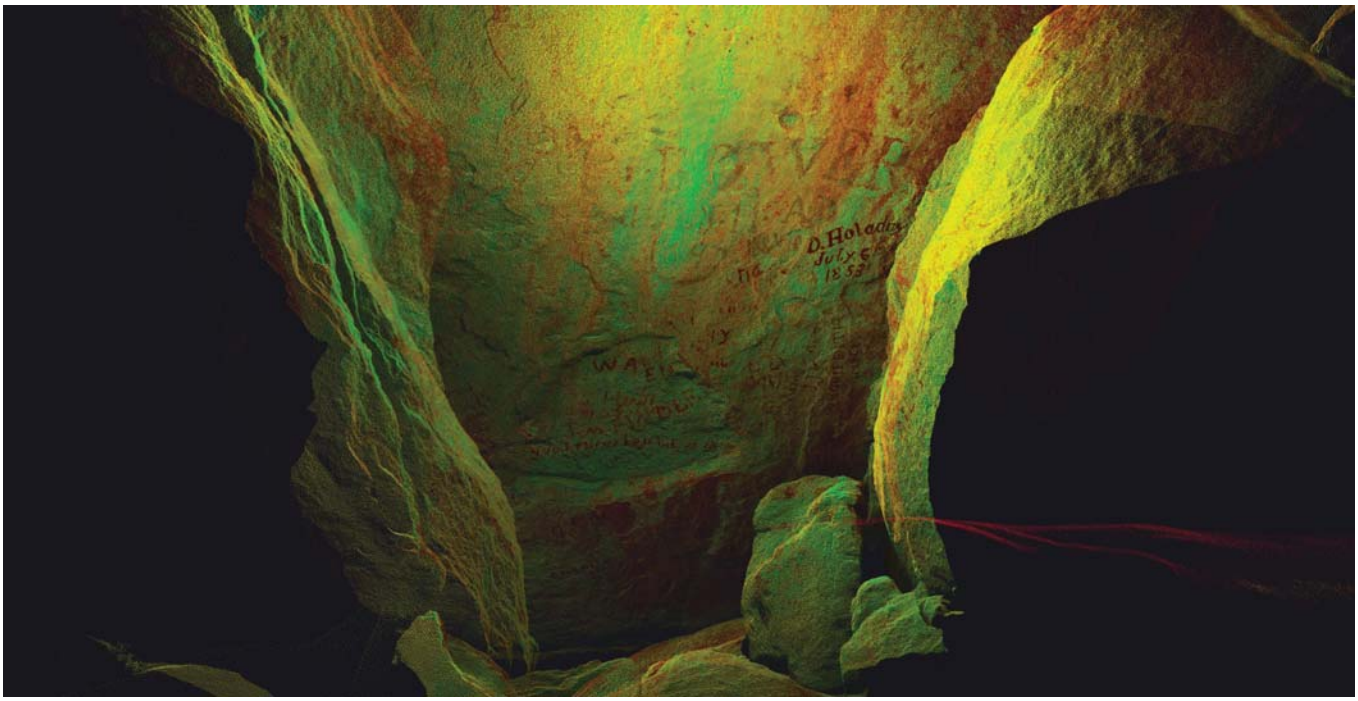
Photo-textured view of historic inscriptions on the roof of the cave at Independence Rock



Intensity-value view of historic inscriptions on the roof of the cave at Independence Rock

[7] HDR Photographs

Inscriptions on top of rock with scanner in background


Inscriptions on top of rock


View looking South at Independence Rock

View of top of rock with Sweetwater Creek in background

Inscription 'H. Graham' in foreground with Rattlesnake Mtns behind

View of Scanner on Independence Rock

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View looking towards Register Cliff

View from the Northeast looking at the entire length of the rock

Close-up view of historic inscriptions near cave

View of South end of rock with Sweetwater creek in foreground

View from top of rock looking Northwest

Mike Nulty and state park employee on top of rock

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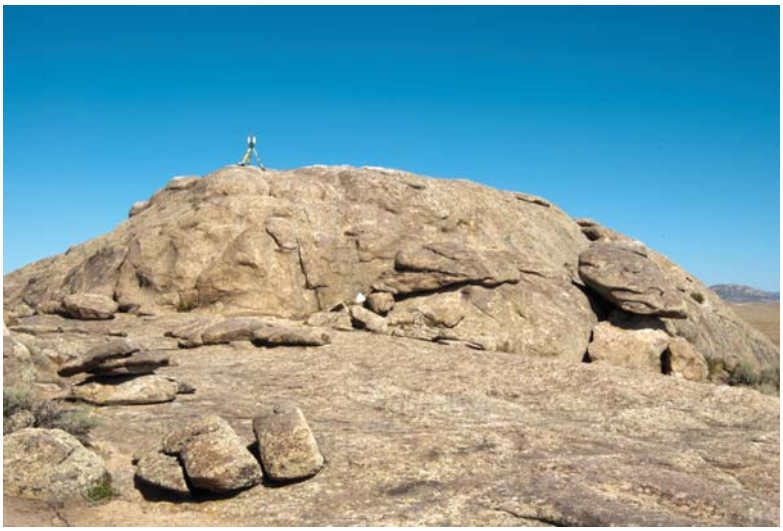
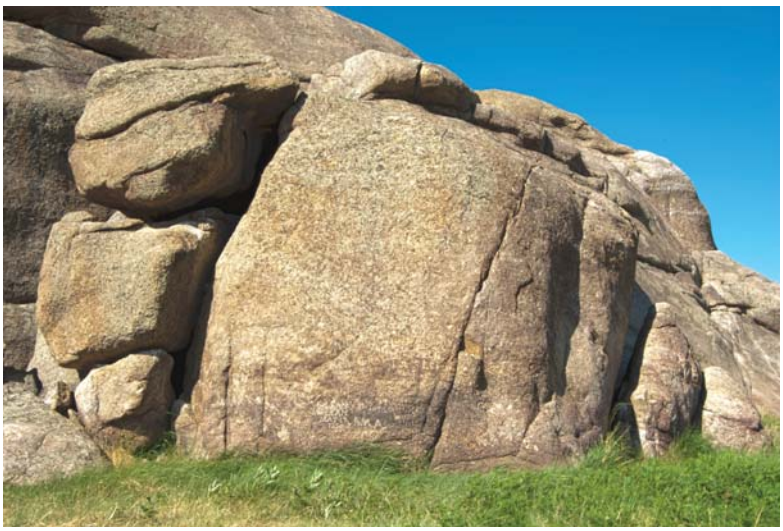
Scanner in foreground with Register Cliff mountains behind



Scanner on top of South end of Independence Rock



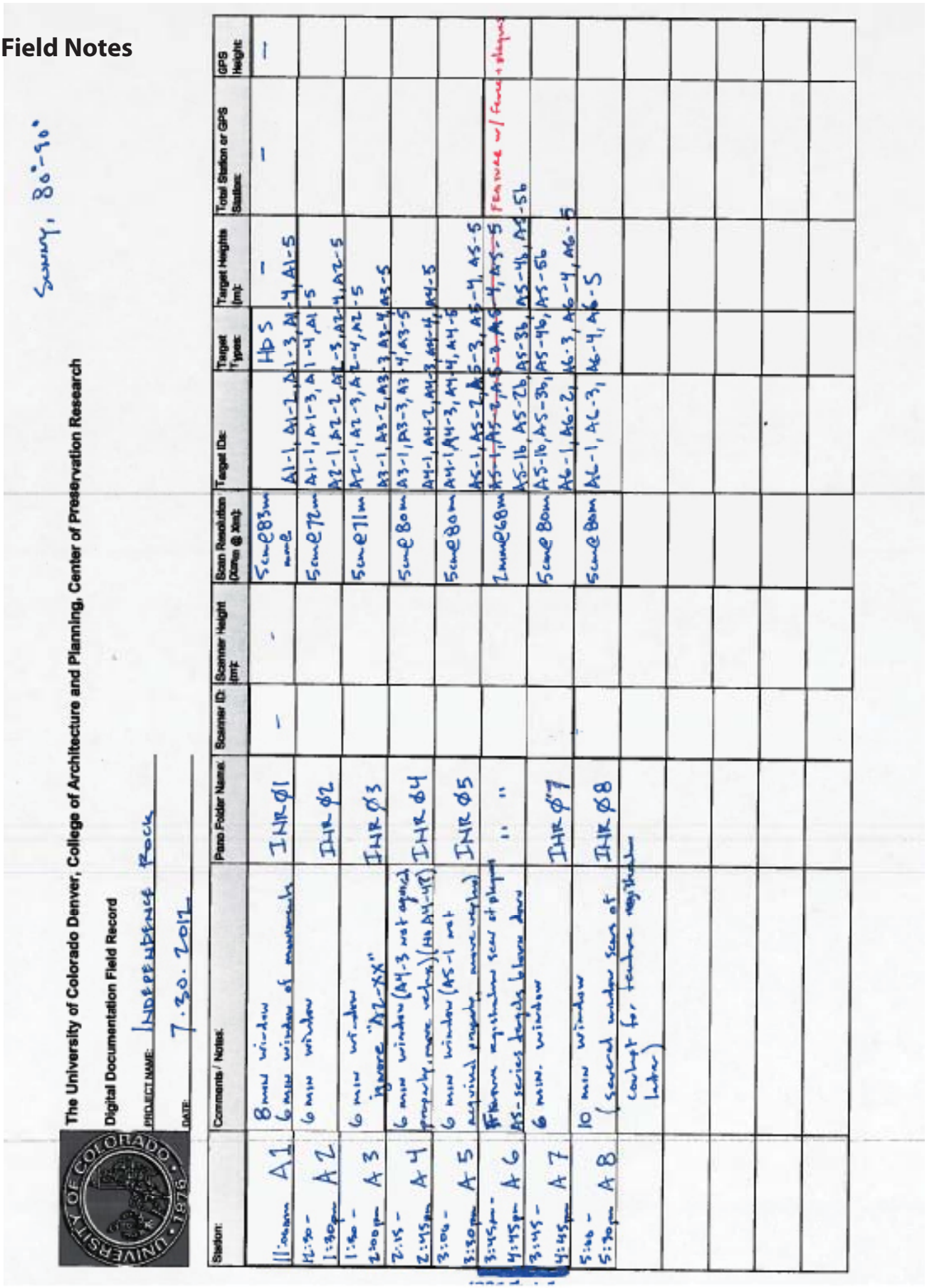
Ground view of rock with inscriptions near the base

Mike Nulty running scanner on top of Independence Rock

HDS targets on top of Independence Rock

Inscriptions on top of rock with scanner behind

[8] Field Notes



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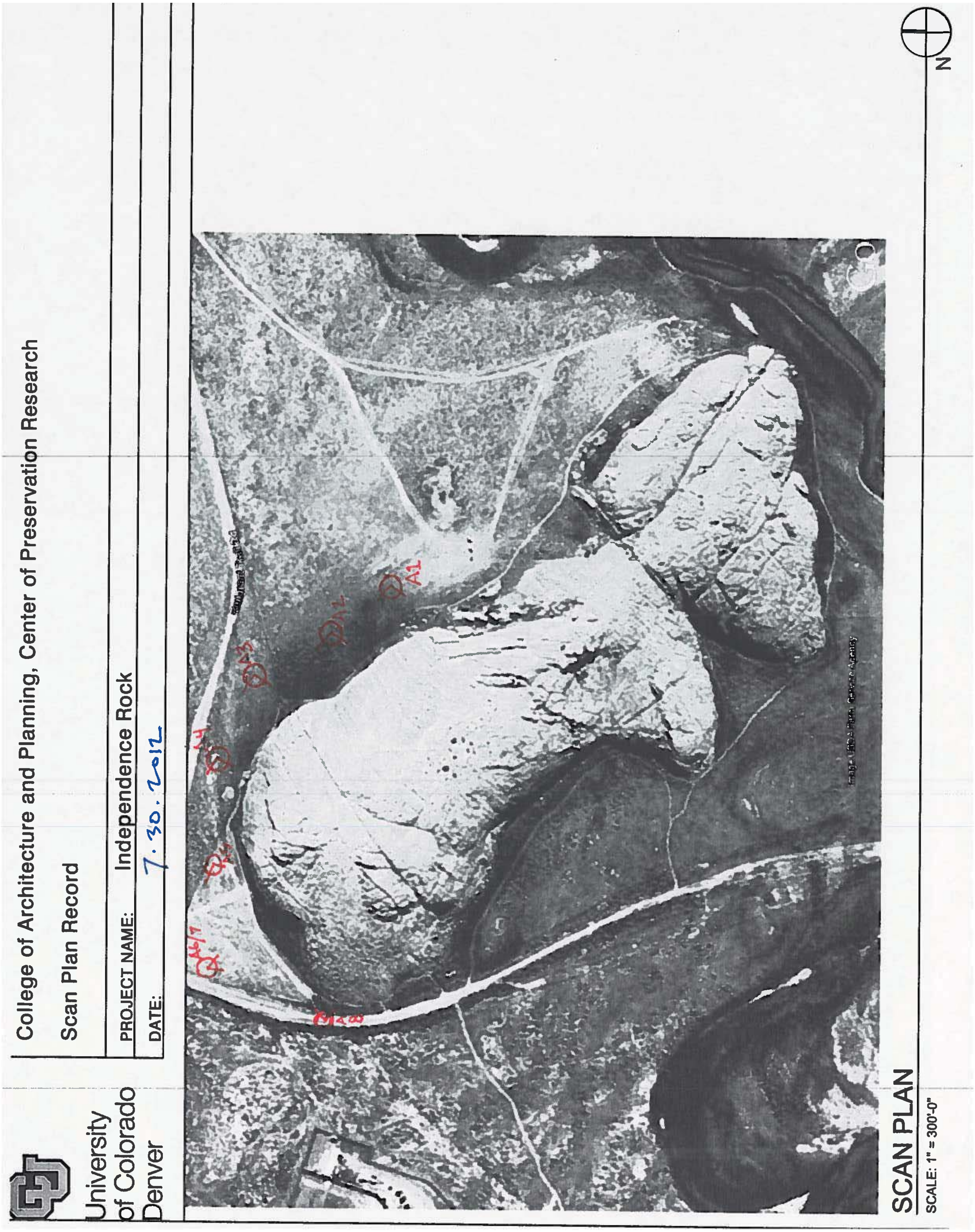
Digital Documentation Field Record

PROJECT NAME: Independence Rock

DATE: 7.30.2012

Sunny, 80°-90°

Station:	Comments / Notes:	Pano Folder Name:	Scanner ID:	Scanner Height (m):	Scan Resolution (Quality @ Xm):	Target IDs:	Target Types:	Target Heights (m):	Total Station or GPS Station:	GPS Height:
11:00am A1	8mm window 6 min window of mountains	IHR01	-	-	5mm@83m 6mm	A1-1, A1-2, A1-3, A1-4, A1-5	HDS	-	-	-
12:30- 1:30pm A2	6 min window	IHR02			5mm@72m	A1-1, A1-3, A1-4, A1-5 A2-1, A2-2, A2-3, A2-4, A2-5				
1:30- 2:00pm A3	6 min window ignore "A2-XX"	IHR03			5mm@71m	A2-1, A2-3, A2-4, A2-5 A3-1, A3-2, A3-3, A3-4, A3-5				
2:15- 2:45pm A4	6 min window (A4-3 not aligned properly, more votes)(Ha A4-4?)	IHR04			5mm@80m	A3-1, A3-3, A3-4, A3-5 A4-1, A4-2, A4-3, A4-4, A4-5				
3:00- 3:30pm A5	6 min window (A5-1 not acquired properly, more votes)	IHR05			5mm@80m	A4-1, A4-3, A4-4, A4-5 A5-1, A5-2, A5-3, A5-4, A5-5				
3:45pm- 4:15pm A6	Known registration issue at player AS- series heights lower down	" "			1mm@68m	~~A5-1, A5-2, A5-3, A5-4, A5-5~~ A5-1b, A5-2b, A5-3b, A5-4b, A5-5b		Feature w/ Fence + player		
3:45- 4:45pm A7	6 min. window	IHR07			5mm@80m	A5-1b, A5-3b, A5-4b, A5-5b A6-1, A6-2, A6-3, A6-4, A6-5				
5:00- 5:30pm A8	10 min window (several window scans of ceiling for feature registration later)	IHR08			5mm@80m	A6-1, A6-3, A6-4, A6-5				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College of Architecture and Planning, Center of Preservation Research
Scan Plan Record
PROJECT NAME: Independence Rock
DATE: 7.30.2012
SCAN PLAN
SCALE: 1" = 300'-0"
N

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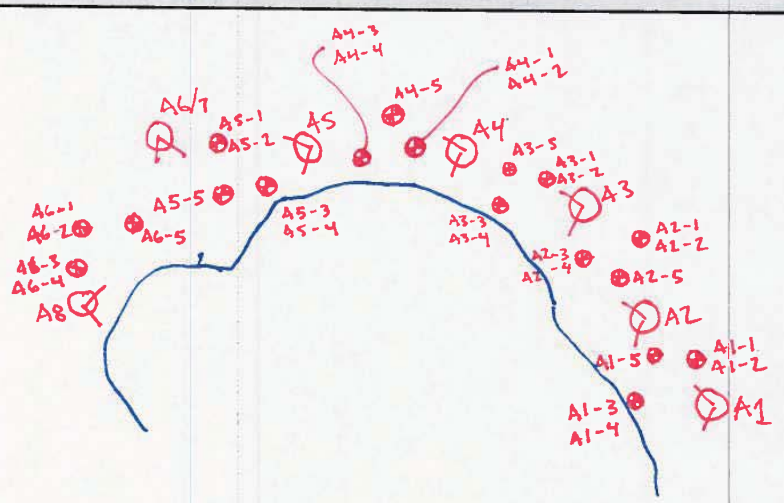
Digital Documentation Field Record

PROJECT NAME: INDEPENDENCE ROCK

DATE: 7.30.2012

Site Sketch: SCANNER LOCATIONS & TARGET LOCATIONS



Day 1 Scan Plan

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TARGETS: 1 3 5 2 4

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Digital Documentation Field Record

PROJECT NAME: INDEPENDENCE ROCK

DATE: 7.31.2012

Station:	Comments / Notes:	Pano Folder Name:	Scanner ID:	Scanner Height (m):	Scan Resolution (Xmm @ Xm):	Target IDs:	Target Types:	Target Heights (m):	Total Station or GPS Station:	GPS Height:
B1	360° w 22 min. 10 min. window of rock	INR 09	NA	NA	10cm@80m 5cm@80m	B1, B1-2, B1-3, B1-4, B1-5, F	HDS FEATURE REG. w/ B1 @ Monument +		fire pit	
B2	6 min. window of rock	INR 10	"	"	5cm@80m	B1, B1-2, B1-3, B1-4, B1-5 B2-1, B2-2, B2-3, B2-4, B2-5				
B3	7 min. window of rock	INR 11	"	"	5cm@80m	B2-1, B2-2, B2-3, B2-4, B2-5 B3-1, B3-2, B3-3, B3-4, B3-5				
B4	15 min. window of rock	INR 12	"	"	1cm@50m	B3-1, B3-2, B3-3, B3-4, B3-5 B4-1, B4-2, B4-3, B4-4, B4-5				
B5	360° w 8 min. min. window of gravel	INR 13	"	"	5cm@20m 1mm@20m	B4-1, B4-3, B4-4, B4-5, B4-6, B4-7				
B6	360° w 45 min. "CAVE SIDE"	INR 14	"	"	1cm@10m	B4-5, B4-6, B4-7				
B7	10 min. window of rock	INR 15	"	"	5cm@80m	B4-1, B4-2, B4-3, B4-4, B4-5 B5-1, B5-2, B5-3, B5-4, B5-5				
B8	9 min. window of rock	INR 16	"	"	5cm@80m	B5-1, B5-2 B5-3, B5-4, B5-5 B6-1, B6-2, B6-3, B6-4, B6-5				
B9	7 min. window of rock	INR 17	"	"	5cm@80m	B6-1, B6-2, B6-3, B6-4, B6-5 B7-1, B7-2, B7-3, B7-4 B7-5				
B10	15 min window of rock	INR 18	"	"	5cm@100m	B7-1, B7-2, B7-3, B7-4, B7-5 B8-1, B8-2, B8-3, B8-4, B8B-5				
B11	360° w 30 min. 15 min. window of rock	INR 19			10cm@100m 5cm@100m	B8-1, B8-2, B8-3, B8-4, B8B-5 B9-1, B9-2, B9-3, B9-4, B9-5				
B12	11 min. window of rock	INR 20			5cm@100m	B9-1, B9-2, B9-3, B9-4, B9-5 B9-6, B9-7 → over USGS monument				
						window scans of benches, fencing for feature registration with C1				

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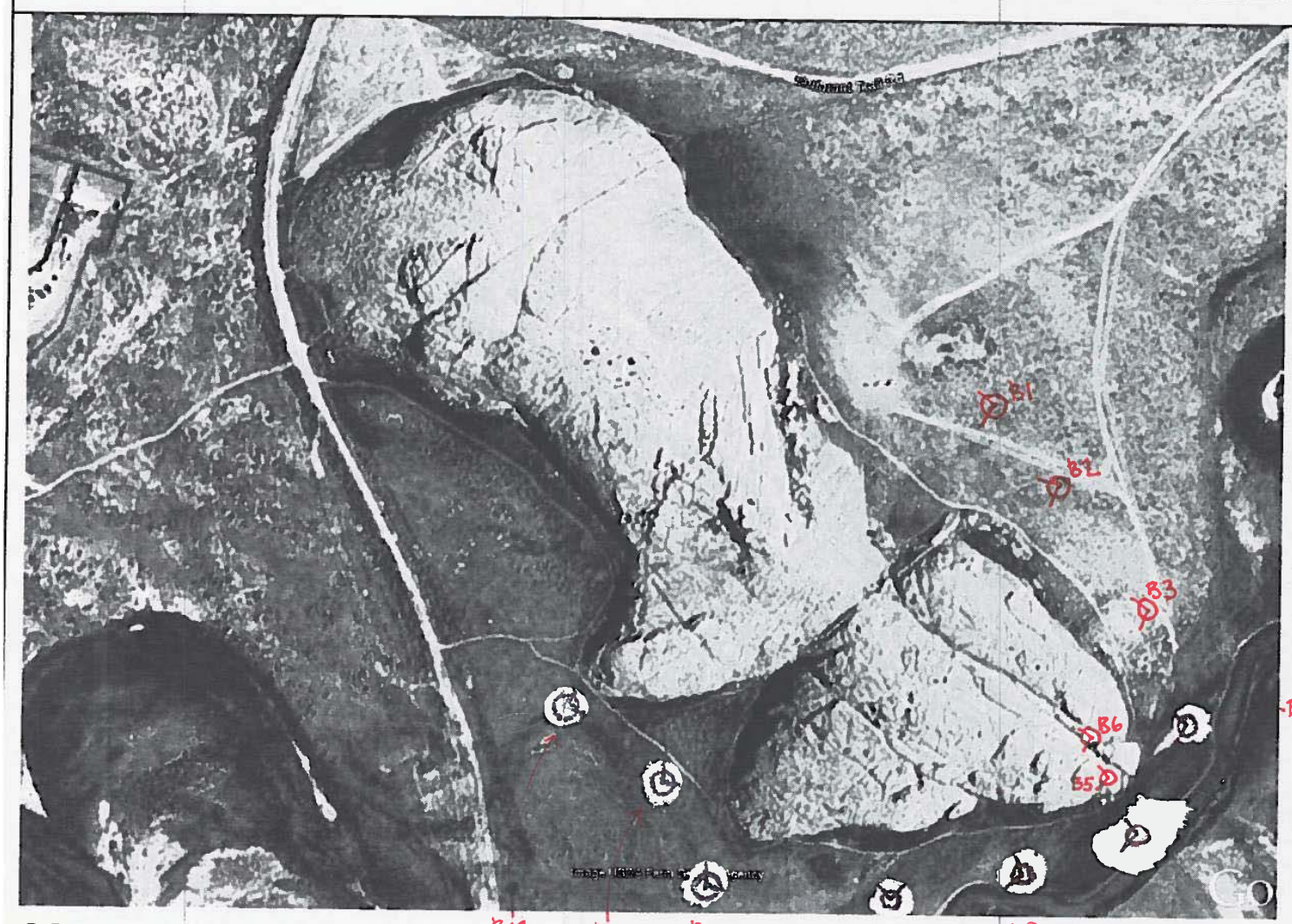
Scan Plan Record

PROJECT NAME: Independence Rock

DATE: 7.31.2012



SCAN PLAN

SCALE: 1" = 300'-0"

N

Day 2 Scan Plan

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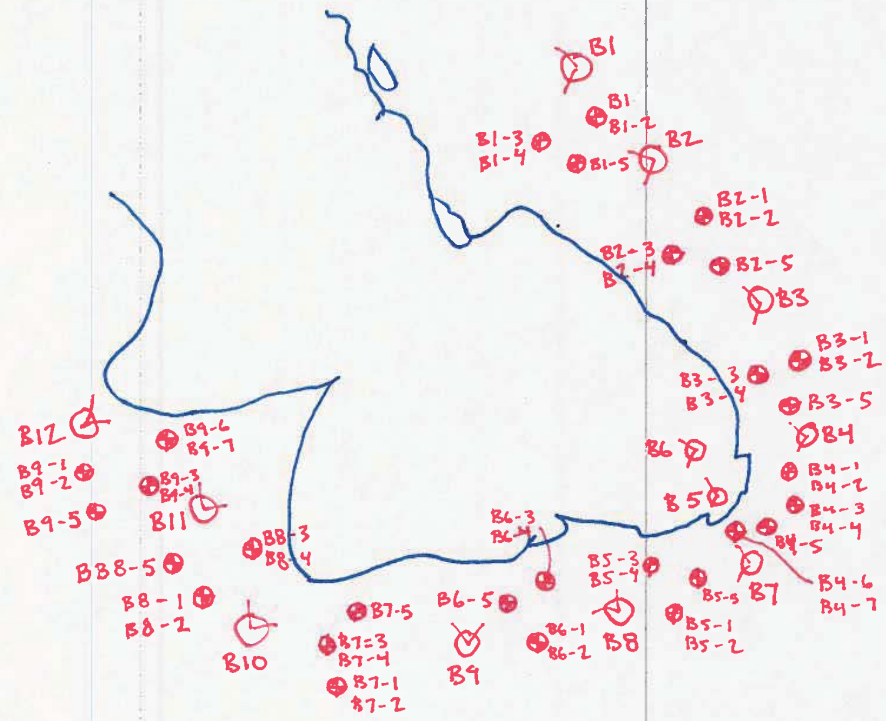
Digital Documentation Field Record

PROJECT NAME: INDEPENDENCE ROCK

DATE: 7.31.2012

Site Sketch: SCANNER & TARGET LOCATIONS



Day 2 Scan Plan

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Digital Documentation Field Record

PROJECT NAME: INDEPENDENCE ROCK

DATE: 8-1-2012

Station:	Comments / Notes:	Pano Folder Name:	Scanner ID:	Scanner Height (m):	Scan Resolution (Xmm @ Xm):	Target IDs:	Target Types: X	Target Heights (m): X	Total Station or GPS Station: X	GPS Height: ✓
7am-8am C1	12 min. window scan of rock wind. scan of H. Fisk 1911	INR2Øb	NA	NA	5cm@80m 1mm@80m	FEATURE REG. w/ BIZ C1-1, C1-2, C1-3, C1-4, C1-5		(Fence, benches, etc.)		
8am-9am C2	15 min. window scan of rock	INR 21	"	"	5cm@100m	C1-1, C1-2, C1-3, C1-4, C1-5 C2-1, C2-2, C2-3, C2-4, C2-5				
9am-10am C3	11 min. window scan of rock (targets C3-1, C3-2 shifted after turning)	INR 22	"	"	5cm@100m	C2-1, C2-2, C2-3, C2-4, C2-5 C3-1, C3-2, C3-3, C3-4, C3-5				
10am-11am C4	360° in 20 min. 11 min. window scan of rock	INR 23	"	"	10cm@100m 5cm@180m	C3-1, C3-2, C3-3, C3-4, C3-5 CAM FEATURE REG.		w/ AB if required	(mobile boom, etc.)	
11am-12pm C5	360° in 30 min. (Rock Top)	INR 24	"	"	5cm@80m	C3-1, C3-2, C3-3, C3-4, C3-5 C4-1, C4-2, C4-3, C4-4, C4-5, C4-6				
C6	360° in 30 min. 5 min. window of July 4, 1850	INR 25	"	"	5cm@80m 1mm@5m	C4-1, C4-2, C4-3, C4-4, C4-5, C4-6, C4-7				
C7	360° in 30 min. Min. wind. of Milo Ayers	INR 26	"	"	5cm@80m 1mm@20m	C4-1, C4-2, C4-3, C4-4, C4-5, C4-6, C4-7				
C8	360° in 30 min.	INR 27	"	"	5cm@80m	C4-1, C4-3, C4-5, C4-6, C4-4 C5-1, C5-2, C5-3, C5-4, C4-5				
C9	360° in 30 min.	INR 28	"	"	5cm@80m	C5-1, C5-2, C5-3, C5-4, C5-5				
C1Ø	360° in 30 min.	INR 29	"	"	5cm@80m	C5-1, C5-2, C5-3, C5-4, C5-5 ↳ do not use				

Day 3 Field Notes

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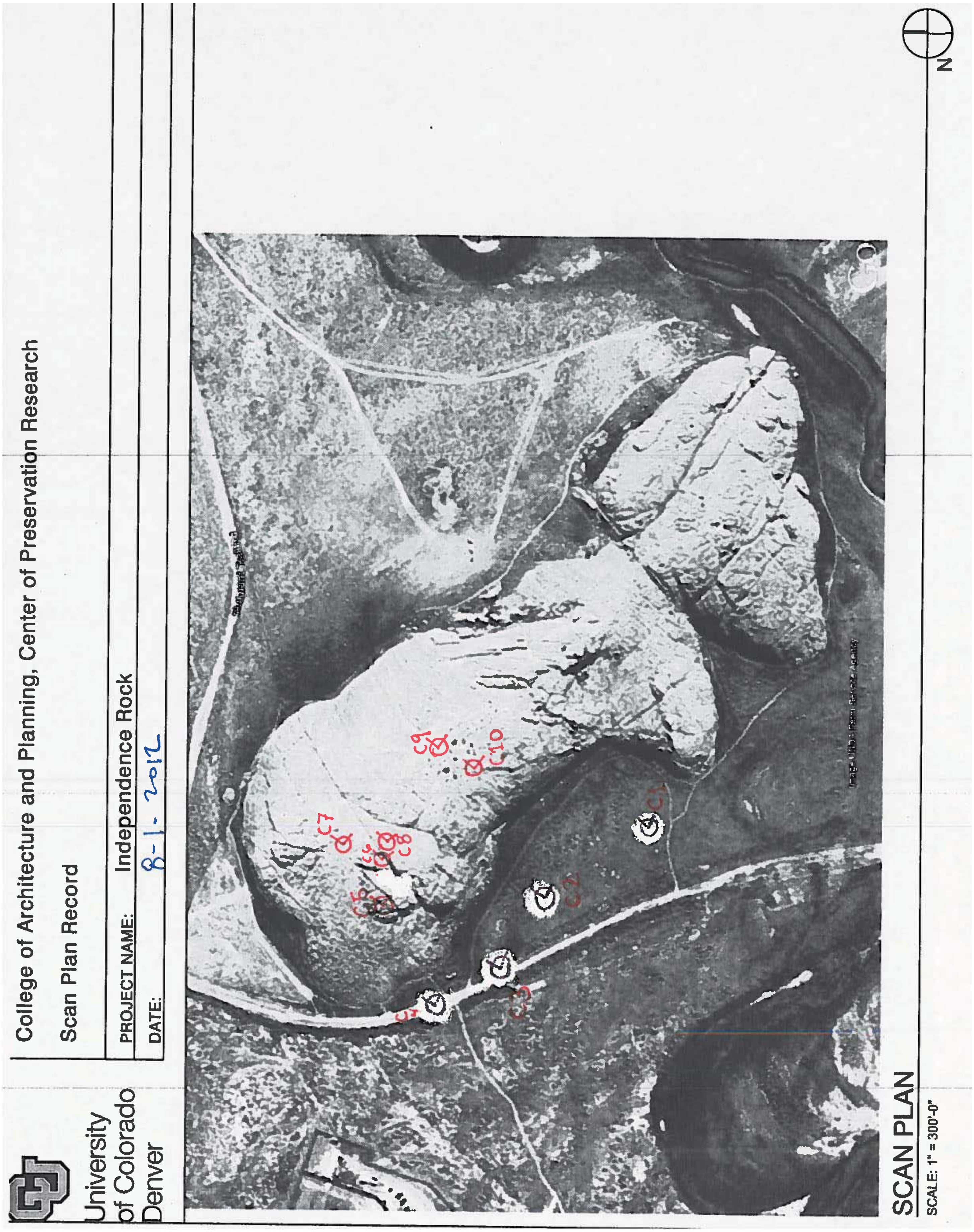
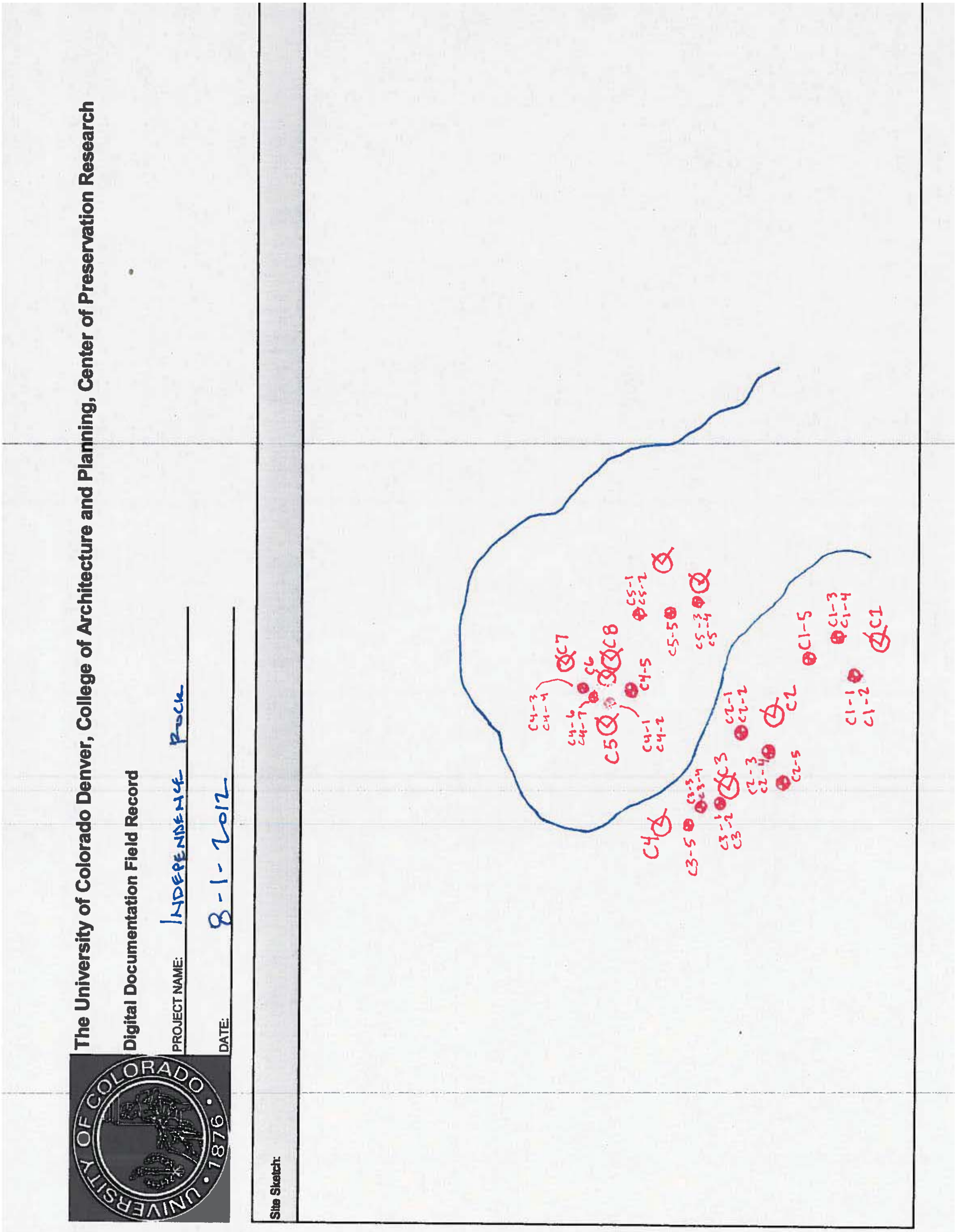

College of Architecture and Planning, Center of Preservation Research
Scan Plan Record
PROJECT NAME: Independence Rock
DATE: 8-1-2012
University of Colorado Denver
SCAN PLAN
SCALE: 1" = 300'-0"
N
C1
C2
C3
C5
C6
C7
C8
C9
C10


The University of Colorado Denver, College of Architecture and Planning, Center of Preservation Research
Digital Documentation Field Record
PROJECT NAME: INDEPENDENCE ROCK
DATE: 8-1-2012
Site Sketch:

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Digital Documentation Field Record

PROJECT NAME: INDEPENDENCE ROCK

DATE: 8.2.2012, 8.3.2012

Station:	Comments / Notes:	Pano Folder Name:	Scanner ID:	Scanner Height (m):	Scan Resolution (Xmm @ Xm):	Target IDs:	Target Types:	Target Heights (m):	Total Station or GPS Station:	GPS Height:
7:30am-8:30 D1	360° scan ~ 30 min.	INR 30	NA	NA	5cm@80m	FEATURE REG. w/ C D1-1, D1-2, D1-3, D1-4, D1-5	10 (			
8:30am-9:30 D2	360° scan ~ 30 min.	INR 31	"	"	5cm@80m	D1-1, D1-2, D1-3, D1-4, D1-5 D2-1, D2-2, D2-3, D2-4, D2-5				
9:30am-10:30 D3	360° scan ~ 30 min.	INR 32	"	"	5cm@80m	D2-1, D2-2, D2-3, D2-4, D2-5 D3-1, D3-2, D3-3, D3-4, D3-5				
10:30am-11:30 D4	360° scan ~ 30 min. (windy)	INR 33	"	"	5cm@80m	D3-1, D3-2, D3-3, D3-4, D3-5				
11:30am-12:30pm D5	360° scan ~ 30 min. (targets D3-1, D3-2 BLEW OVER)	INR 34	"	"	5cm@80m	D3-1, D3-2, D3-3, D3-4, D3-5 D4-1, D4-2, D4-3, D4-4, D4-5				
8.2.2012	WIND KICKED UP AT ABOUT NOON, BLEW OVER MOST TARGETS AND MADE IT IMPOSSIBLE TO BOOT UP SCANNER.									
8.3.2012										
6:00am-7:00am E1	360° scan ~ 25 min. (ON SAME SPOT AS D5	INR 35	NA	NA	5cm@80m	~~E1-1~~ FEATURE REG. w/ D5 E1-1, E1-2, E1-3, E1-4, E1-5				
7:00am-8:00 E2	360° scan ~ 27 min.	INR 36	"	"	5cm@80m	E1-1, E1-2, E1-3, E1-4, E1-5 E2-1, E2-2, E2-3, E2-4, E2-5				
8:00am-9:30 E3	360° scan ~ 30 min.	INR 37	"	"	5cm@80m	E2-1, E2-2, E2-3, E2-4, E2-5 E3-1, E3-2, E3-3, E3-4, E3-5				
9:30am-10:30 E4	360° scan ~ 30 min.	INR 38	"	"	5cm@80m	E3-1, E3-2, E3-3, E3-4, E3-5 E4-1, E4-2, E4-3, E4-4, E4-5				
10:30am-11:30am E5	360° scan ~ 30 min.	INR 39	"	"	5cm@80m	E4-1, E4-2, E4-3, E4-4, E4-5				

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Scan Plan Record

PROJECT NAME: Independence Rock

DATE: 8.2.2012, 8.3.2012

SCAN PLAN

SCALE: 1" = 300'-0"

N

Day 4 & 5 Scan Plan

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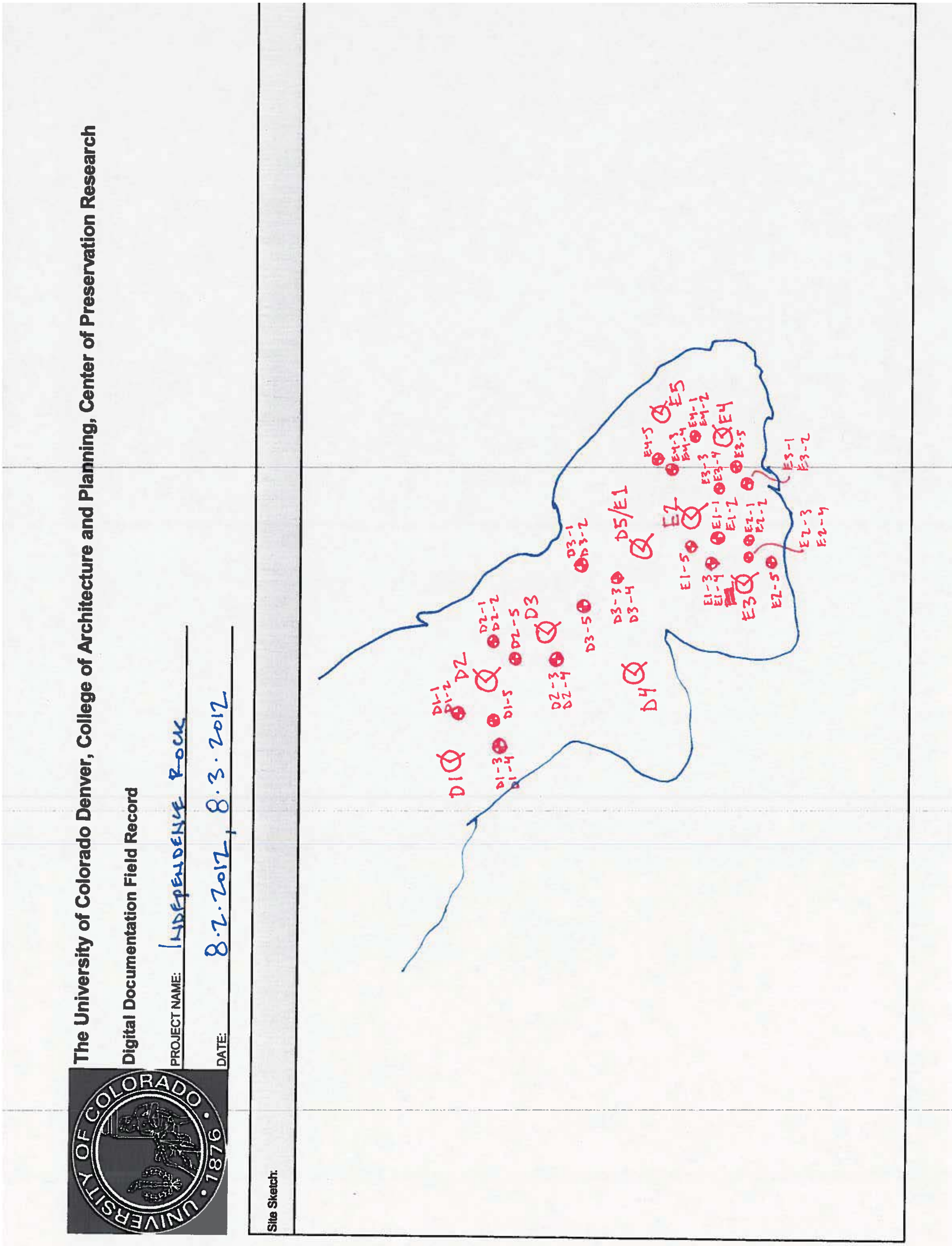
The University of Colorado Denver, College of Architecture and Planning, Center of Preservation Research
Digital Documentation Field Record
PROJECT NAME: INDEPENDENCE ROCK
DATE: 8·2·2012, 8·3·2012
Site Sketch:
UNIVERSITY OF COLORADO 1876
D1
D2
D3
D4
D5/E1
E2
E3
E4
E5

Name	Page #	Year	Location	*Ellison*	Other	Condition	Risk
Allred, R. W.	128	1849	S	?	Actual inscription: **R.W. Allred A. Taylor & Co.** (see also Alien Taylor)		
Ayer, Milo J.	132	1849	NET	found	other avail. Reference : *The Boston Newton Company Venture* , J. Gould		
Coon, Wm	158	(1850)	S	found	Seen as **W. M. Coon** by later survey		
Crosby, J. W.	162	(1847 -1853)	S	found	**(Picture)** Journal entry from avail.: *Annals of Wyoming, Vol. II #3, 1939*		
Draper, Bishop W.	170	(1849)	S	found	**(Picture)** Diary entry given *"Draper p. 74"*		
Ebey, W. S.	174	1854	NET	?	**(Picture)** Diary entry given *"Ebey, Diary p. 103"* (hard to reach location)		
Elgin, Rilla	177	1852	MT	found	Diary entry given *"Over the Plains 50 Years Age"* James Henry Elgin		
Fox, G. O.	185	(1852)	MT	found	Diary of Jared Fox: *"Mattes"* p. 356 (see also **Foy, J**)		
Foy, J.	185	1852	SE	?	This may otherwise be Jared Fox (took only 3 months from WI to OR)		
George, A. L.	187	1849	S	found	refer to **Tate, Jas.** entry (traveled and arrived at rock together)		
Gray, C.	190	(1849)	S	?	Diary entry given for Charles Glass Gray, *"Gray Off at Sunrise"* p. 44		
Haynes, A.	200	1849	S	found	Diary available "Platte River Narratives" pg. 166		
Hobart, R.E.	204	1849	S	found	for mor info on Randall Hobart see *"The World Rushed in"* J.S. Holliday		
Howard, E. W.	207	1852	SW crnr	?	recollections of journey in *"Platte River Narratives"* pg. 364		
Jacob, Norton	211	1847	NT	?	**(Picture p. 33)** Only inscription of B. Young 1847 Pioneer Party found		
Keller, George H.	216	1850	S	found	Journal entries avail.: *"Platte River Narratives"* p. 70 & *"WY Annals"* p. 71		
Mason, J.	232	(1850 ?)	EMT	found	Diary available *"Platte River Narratives"* pg. 280		
McBride, J.	233	(1846) or (1850)	CAVE	found	3 Diff Diary entries of possible J. McBride: *"Platte River Nar. "* p.82 &277		
Morgan, J.W.	242	(1849)	NT	found	Diary of Marth Morgan Avail.: *"Morgan"* p. 5		
Morris, Elias & Mary	244	1852	NT	found	**(Picture)** Detailed info about travel given.		
Patteson, W. W.	255	(1849)	E crnr	?	Diary avail: *"Platte River Narratives"* p. 197		
Porter, J., Inc.	258	(1847)	NMT	found	**(Picture)** Possibly the first school teacher in Morgan County		

* **Date** given in Parenthesis is NOT inscribed, but only given from written descriptions in book

* ***Ellison*** column explains whether the inscription has been <u>found,</u> or if it was not indicated whether or not it was found since Elison's survey

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Name	Page #	Year	Location	*Ellison*	Other	Condition	Risk
Rathbun, J.	261	(1849)	NT	found	Good account of party's trip in: *"The Buckeye Rovers in the Gold Rush"*		
Reid, B.	262	(1849)	NET	?	(Picture) Diary avail.: *"Gordon"* p. 81-84		
Rinehart, J.	265	1852	S	?	(Picture) Detailed info about travel given		
Secrist, J.	272	1855	NT	found	Brief history given about who this may be		
Tate, Jas.	290	(1849)	S	found	(Pic of Inscription) Diary: *"One Who Went West" Platte River Nar.* P. 217		
Warner, W. C.	303	(1853)	NE	?	Letter available: *"Overland to California:Letter from an Ohio Argonaut"*		
Weaver, D.	304	(1850)	S	?	Traveled with **Keller, George.** See Keller's journal entiries		
B9 Wertz, H.M. ✓	305	1850	S	found	Traveled with **Keller, George.** See Keller's journal entiries		
Williams, J.	310	1852	MT	found	Letters passed down in family: *"Platte River Narratives"* p. 398		
Williams, J. A.	310	(1851)	E crnr	?	Diary of trip avail: *"Mattes, Platte River Narratives"* p. 333		
Wright, John	315	(1852)	CAVE	found	(Picture) Good description given		

* **Date** given in Parenthesis is NOT inscribed, but only given from written descriptions in book
* ***Ellison*** column explains whether the inscription has been <u>found,</u> or if it was not indicated whether or not it was found since Elison's survey

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DAY 2

The University of Colorado Denver, College of Architecture and Planning, Center of Preservation Research

Digital Documentation Field Record

PROJECT NAME: INDEPENDENCE ROCK - PHOTOGRAMMETRY & INSCRIPTIONS

DATE: 7-30-12

Photogram ID Station: Y Z	Comments / Notes:	Pano Folder Name:	Scanner ID:	Scanner Height (m):	Pg in Book / Location in Book	Target IDs:	Target Types	Target Heights (m)	Total Station or GPS Station:	GPS Height:
					Scan Resolution (Xmm @ Xm):	NOTES				
HAR04	E.B. HARRISON July 21, 1851	HAR04	B4	196	S					
HAY04	A. HAYNES July 21, 49 Mass.	HAY04	B4	200	S	- Good Description in book - ON LIST				
BIS04	C.W. BISHOP June 29, 51	BIS04	B4	140	S - Midway up					
~~RAN05~~ RAN05	+ other Names J.H. RAINES June 18, 60	RAN05	B5	147, 208, 261	Just outside CAVE					
CHM06	Age 25 CHAMBERLAIN JUN 19, 1849	CHM06	B6	154	IN CAVE					
HOL06	+ Others D. HOLADAY July 6, 1853	HOL06	B6	205	IN CAVE					
PRO05	+OTHERS PROTHERO, SAMUEL Jul 2, 50	PRO05	B5	260	outside of cave	- others include: J.F. Simpson (p. 276) J. Howell (p. 207), + Deadrotff (p. 168)				
WDG09	WEDGE along SOUTH Face - Includes many Names	WDG09	B9		S	- Names of some: A.W. Bailey (p 134), E.J. Freeman (p. 184), D. Richardson MD (p. 264), H.L. CHAPIN (P. 155), etc.				
KON10	G. KON + others	KON10	B10	221	W	- others: H. Loomis + E. Cameron (p 151) C.B. Woodruff NW (p. 314)				
CUD10	P. CUDIHY Co F 4th Calvalry ~~P G C E~~	CUD10	~~B10~~ B11	163	SW					

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DAY 3

The University of Colorado Denver, College of Architecture and Planning, Center of Preservation Research

Digital Documentation Field Record

PROJECT NAME: INDEPENDENCE ROCK - PHOTOGRAMMETRY & INSCRIPTIONS

DATE: ~~8-30~~ 8-1-12

Photogram ID Station: AY 3	Comments / Notes:	Pano Folder Name:	Scanner ID:	Scanner Height (m):	Scan Resolution (#mm @ Xm):	Pg. in BK / Location in BK / NOTES — Target ID:	Target Types:	Target Heights (m):	Total Station or GPS Station:	GPS Height:
AYRNT (North top)	AGE 29 MILO J. AYER 1849 Mass.	AYRNT	C7	132	net	Fine Scanned by C7 — ON LIST				
MDYNT (North top)	A.E. MOODY July 8, 1853	MDYNT	C7	241	nt, net	Others: W.S. Williams (p. 311), W.W. GILBERT (p 188) > good info in BOOK				
MOR08	J.W. MORGAN + others	MOR08	C8	242	mt	ON LIST				
MRS08	ELIAS + MARY MORRIS N. WALES, Pa. Sept 12, 1852	MRS08	C8	244	nt	ON LIST				
MCD06	R. McCORD July 4, 1850	MCD06	C6	234	nt					
KOHWM (west middle)	H.L. KOEHNE Capt 64. Piqua, Ohio 11th OVC miss.	KOHWM		221	e boulder	also Name: E.E. RUGGER 64 MO Telegraph opr (p. 268)				
DAK10	D. DEAKINS June 7, 1853	DAK10	C10	167	nmt	Became Sheriff in area (Told by Patrick)				
HUG10	I.J. HUGHES + others July 4, 1850	HUG10	C10	208	nmt	also named: C.W. Lewis, C.W. Russell, H.E. Rigger > June 15, 1853 Knoxville, IL (Pg. 215, area 268)				
FOX01	FAOS FOX Cinc. Ohio June 29/52 +others	FOX01	D1	185	mt	With Many other Names, Fine Scan w/ D1 — Photography award won for PIC of this ROCK (Patrick)				
BEM10	H.P. BEMISS July 4, 1850	BEM10	C10	139	nmt					
SPH10	E. SAPH July 9, 1853 +others	SPH10	C10	270	nmt	Others: E.D. Rx CUTLER (p 165), C.M. POTNEY (p. 268) L. FOWLER '52 (p 185), T. BROWN (p 146)				
SNW04	B. SNOW June 10, 1853	SNW04	C4	282	nm (midway up rock)					

1512 Larimer Street, Ste. 750
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DAY 4

The University of Colorado Denver, College of Architecture and Planning, Center of Preservation Research

Digital Documentation Field Record

PROJECT NAME: INDEPENDENCE ROCK - PHOTOGRAMMETRY & INSCRIPTIONS

DATE: 8-2-12

Photogrammetry ID Station: DAY 4	Comments / Notes:	Pano Folder Name:	Scanner ID:	Pg. in BK Scanner Height (m):	Location in BK Scan Resolution (5mm @ ?m):	Notes Target ID:	Target Types:	Target Heights (m):	Total Station or GPS Station:	GPS Height:
CLK01	L.P. CLARK June 9, 50 LaPorte, Indiana	CLK01	D1	156	mt					
BRW01	LIEUT BROWN TROY, OH 10	BRW01	D1	145	met					
HOL02	J.J. HOLLINGSWORTH June 11, 1862 6th OHIO VC.	HOL02	D2	205	mt					
NEL02	M + H.W. NEAL July 20, 59 + others ILLS	NEL02	D2	247	mt					
ARM02	T.H. ARMSTRONG July 12 1852 + others	ARM02	D2	130	mt	Others: J.M. Davis (p.167) E.B. CHAPMAN (155) – Large Panel Fine Scanned By D2				
CRB09	J.W. CROSBY + others	CRB09	B9	162	S	– same wedge as WDG09 – ON LIST				
WTZ09	H.M. WERTZ (very Faint)	WTZ09	B9	305	S	– ON LIST				
BWR09	SAMUEL BOWER	BWR09	B9	143	S					
KLR07	GEORGE H. KELLER	KLR07	B7	216	S	– ON LIST				
DRP07	BISHOP W. DRAPER	DRP07	B7	170	S	– ON LIST				
HBR08	R. HOBART + others Aug 11, 49	HBR08	B8	204	S	– Also: D. Webb (p 304), A. TAYLOR (p. 291) – ON LIST				
WRT08	T.S. WART WOUT + others	WRT08	B8		S	– Also: W.B. Hawkins (p. 199), E. ROBERTS (p 265), DD Ellis (178) J.D. Wole (313)				
LEN08	S. + B. LEAN + others 1850	LEN08	B8							

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Photogrammetry Plan