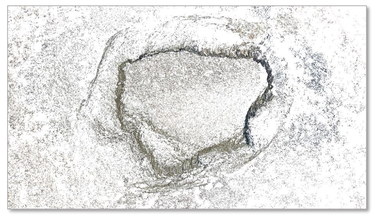
UAS MODELING OF DEVILS TOWER NATIONAL MONUMENT, WY

DEVILS TOWER BACKGROUND

Devils Tower rises 867 feet above the surrounding landscape, and is a prominent monolith of igneous rock. The tower is the monument's primary resource, as identified in its enabling legislation, yet its vertical aspects and summit can only be seen by those with technical rock climbing experience. High resolution imaging allow the park staff to discern fine details of the tower surface, including erosional cracks, and provide a snapshot-in-time document of rock quality conditions. This dataset is used as a baseline to evaluate potential rock fall areas of concern. The digital 3D model allows the park to display climbing routes, pre-plan for rescue operations, and examine nesting sites commonly used by peregrine falcons.

Dense Point Cloud



Point cloud Extraction of Lichen Growth

Ortho Corrected Image
With Contours

Geographic Products :

- Digital Terrain Model 14 cm GSD
- Digital Surface Model 14 cm GSD
- Orthomosaic Image 3.53 cm GSD
- Dense Point Cloud 50.2 points / m^2
- Vector Contours 30.48 cm Interval
- Various Themed Cloud Extractions

3DR Solo Quadcopter was utilized with a Ricoh GR II camera to reconstruct the photogrammetric model .

Textured Surface 3D Model
Photogrammetric Reconstruction
809 Camera Stations, Flying Altitude 147 m

3DR Solo Quadcopter was utilized with a GoPro camera to test wind patterns around the tower for stability.

PROJECT INFORMATION

In October 2016, the USGS and the NPS set out to collect the high resolution imagery required to generate the 3D digital dataset of the tower. Prior to the flights, NPS personnel climbed the tower to place several ground-control targets and conducted ground-truth surveys of ground texture and vegetation. The UAS flights were conducted with a 3D Robotics Solo quadcopter utilizing a Ricoh GR II camera payload. Sections of the viewing trail were closed for public safety while UAS flights were conducted. Twenty flights, over a three-day period, yielded more than 2,000 overlapping photos. The image data was processed using photogrammetry (structure - from-motion) algorithms with surveyed ground control targets and scale markers to georeference the model in three dimensions.

Textured Surface of Southeastern Face

Textured Surface of Southern Face

Overall Spatial Accuracies:

- X = 2.0 cm
- Y = 3.3 cm
- Z = 7.9 cm

Surveyor Collects Ground Control
Near the Summit.

U.S. GEOLOGICAL SURVEY - NATIONAL UNMANNED AIRCRAFT SYSTEMS PROJECT OFFICE
GEOSCIENCES AND ENVIRONMENTAL CHANGE SCIENCE CENTER
DENVER, COLORADO
FEBRUARY 2017