NATIONAL TRANSPORTATION SAFETY BOARD
Office of Aviation Safety
Washington, D.C. 20594

UAS Aerial Imagery Factual Report

7/11/2017

A. ACCIDENT DCA17MR007

Location:	Graettinger, Iowa
Date:	March 10, 2017
Time:	0050 Local Time (CST)
Event:	Union Pacific unit train derailment

B. PERSONNEL

UAS Program Lead:	Bill English National Transportation Safety Board Washington, D.C.
Visual Observer:	Josh Fritz Union Pacific Analysis/Prevention Omaha, Nebraska

C. ACCIDENT SUMMARY

For a summary of the accident, refer to the Accident Synopsis Report in the docket for this investigation, NTSB Docket DCA17MR007

D. DETAILS OF IMAGERY

1.0 Equipment and Procedures

Equipment

The Union Pacific representative conducted initial flights on March 10, 2017, using a DJI Mavic, collecting overview video. Mapping and visual inspection flights were conducted on March 11, 2017, using the NTSB DJI Inspire 1 small unmanned aircraft system (sUAS, commonly known as a drone). The drone is equipped with a dual GPS/GLONASS receiver which provides georeference information on all still photos. The drone was equipped with the X3/FC350 camera using the Sony Exmor 1/2.3" CMOS

sensor, with a focal length of 3.6 mm. Still photo resolution is 12 megapixels in JPG or RAW format.

Procedures

The accident site was in Class G airspace, no specific authorization was required, and the flight was conducted under 14 CFR 107. No other aeronautical, physical, or electromagnetic hazards were identified. The high temperature on the day of the flight was 17°F, near the minimum specified for the aircraft, therefore the team took special attention to keeping batteries and equipment warm.

The Inspire was flown in a series of overlapping grids at 75 feet to develop a 3D model and orthomosaic. Additional flights were taken under the direction of the track group and hazmat group chairmen to obtain images of the main wreckage area, select portions of the track leading to the accident area, and the collapsed trestle. Total flight time was approximately 1.5 hours.

Processing

Geo-referenced still imagery was processed using Pix4D photogrammetry software to provide orthomosaic mapping and 3D modeling of the entire site. Relative accuracy (within the map) was accurate to approximately 0.8 inch (2x ground sample distance). Ground Control Points were not used, resulting in a positional (absolute) accuracy of approximately 21 inches. Further details are included in the Pix4D Quality Report (Attachment 1)

2.0 Imagery products

Approximately 700 high resolution photos and videos were gathered. Still photos and videos were provided to the IIC and investigative team on scene, and select images are included below and in the docket for this accident.

An orthomosaic map of the accident site was developed and exported in Google Earth kmz format. Figure 1 is a sample snapshot of the map, attachment 1 is a full resolution kmz export.

Figure 1 – Snapshot of Orthomosaic Export

Figure 2 is a sample snapshot of the 3D point cloud and mesh model of the accident site. Attachment 3 is an export of the 3D mesh in PDF format, Attachment 4 is a "virtual fly-through" of the 3D model. Figures 3 through 8 are sample still photos.

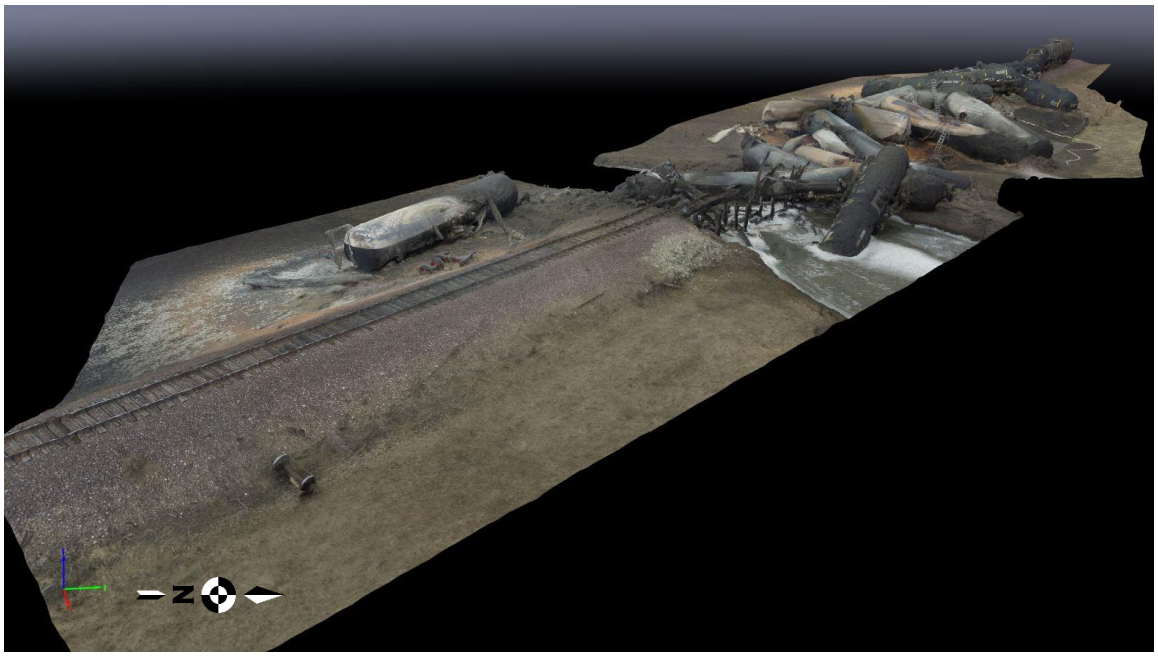

Figure 2 - Snapshot of 3D mesh

Figure 3 – Oblique Overview, looking in the direction of travel

Figure 4 – Overhead of damaged cars, Jack Creek is to the left

Figure 5 – Collapsed trestle looking east, viewpoint is at the original elevation of the trestle.

Figure 6 - Trestle from north side of creek, looking opposite the direction of travel.

Figure 7 - Trestle and fractured track from west side

Figure 8 – Segment of track approaching site along direction of travel

3.0 Attachments

Attachment 1 – Pix4D Quality Report

Attachment 2 – Google Earth kmz export

Attachment 3 – 3D PDF export

Attachment 4 – 3D mesh/point cloud fly through video