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

UAS Aerial Imagery Factual Report

11/30/2017

A. ACCIDENT DCA17FR011

Location:	Hyndman, PA
Date:	August 2, 2017
Time:	0500 Local Time (EDT)
Event:	CSX train derailment

B. PERSONNEL

UAS RPIC:	Bill English National Transportation Safety Board Washington, D.C.
Visual Observer:	Mike Bauer National Transportation Safety Board Washington, D.C.

C. ACCIDENT SUMMARY

For a summary of the accident, refer to the Accident Summary within this docket.

D. DETAILS OF IMAGERY

1.0 Equipment and Procedures

Equipment

Mapping and visual inspection flights were conducted on August 3 and 4, 2017, using the NTSB DJI Phantom 4 Professional 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 is equipped with an FC6310 camera using the Sony Exmor 1" CMOS sensor, with a focal length of 8.8 mm. Still photo resolution is 20 megapixels in JPG or RAW format.

Inspection flights to collect video documentation were conducted on August 3, 2017, using the NTSB DJI Inspire 1 small unmanned aircraft system (sUAS, commonly known as a drone). The drone was equipped with the Z3/FC350 3.5x zoom camera using the Sony Exmor 1/2.3" CMOS sensor, with an effective focal length of 22 to 77mm. Videos

were taken in MP4 format, with 2.7K resolution at 60 frames per second.

Procedures

The accident site was in Class G airspace, no airspace authorization was required, and the flight was conducted under 14 CFR 107. The pilot and observer planned the flights to avoid rapidly rising terrain to the northeast of the main wreckage area, and to avoid hazardous material removal activity. Some minor magnetic and GPS interference was noted during the mapping of the rails, through some cuts in rocky hills on the approach to the main wreckage area, that were easily dealt with using normal operating procedures. Thunderstorms moved into the area on the afternoon of August 3, requiring flight activity to stop until the following day.

The Phantom 4 Pro was flown for multiple sorties including overlapping grids over the main wreckage area, orbits and close ups of the main wreckage area, and corridor mapping missions along 1.8 miles of track from the initial point of derailment to the trestle beyond the main wreckage area. The Inspire was hand-flown to photo and video document the removal of the protective jacket on a burning liquid propane gas (LPG) tank car as well as various viewpoints of the main wreckage area. Total flight time using both drones 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 used in portions of the main wreckage area and along the approach portion of track, resulting in a positional (absolute) accuracy of approximately 21 inches. Hazardous material and removal activity precluded optimal placement of GCPs.

2.0 Imagery products

Approximately 1300 high resolution photos and videos were gathered. Still photos, videos, and initial low-resolution maps and 3D models were provided to the IIC and investigative team on scene. Select images are included below and in the docket for this accident. Full resolution maps and exported models are included in the docket. Figure 1 is an overview of the entire coverage area.

Figure 1 – Overview of entire area

An orthomosaic map of the main wreckage site on Aug 3, was developed and exported in Google Earth kmz format. Figure 2 is a sample snapshot of the map, attachment 1 is a full resolution kmz export.

Figure 2 – Snapshot of Wreckage Day 1 Orthomosaic Export

Figure 3 is a sample snapshot of the 3D model of the main wreckage site on day 1.

Figure 3 – Snapshot of Wreckage Day 1 3D Model

Attachment 2 is a virtual fly-through of the 3D model, attachment 3 is the 3D model in OBJ format. Figures 4 and 5 are sample source photos, full resolution versions are attachments 4 and 5.

Figure 4 – Sample source photo of Wreckage Day 1

Figure 5 – Sample source photo of Wreckage Day 1

The Track Group Chairman accompanied the UAS team to document the section of rail leading up to the main wreckage. The initial point of derailment was approximately 1.8 miles northwest of the main site. Multiple sorties were flown over two days (weather required flights to stop near the end of day 1) and processed into orthomosaic maps of the rail. Figure 6 is a snapshot of a portion of the orthomosaic showing the initial point and witness marks. Figure 7 is a sample source photo showing the marks and initial point.

Figure 6 – Snapshot of Rail Day 1 Orthomosaic Export

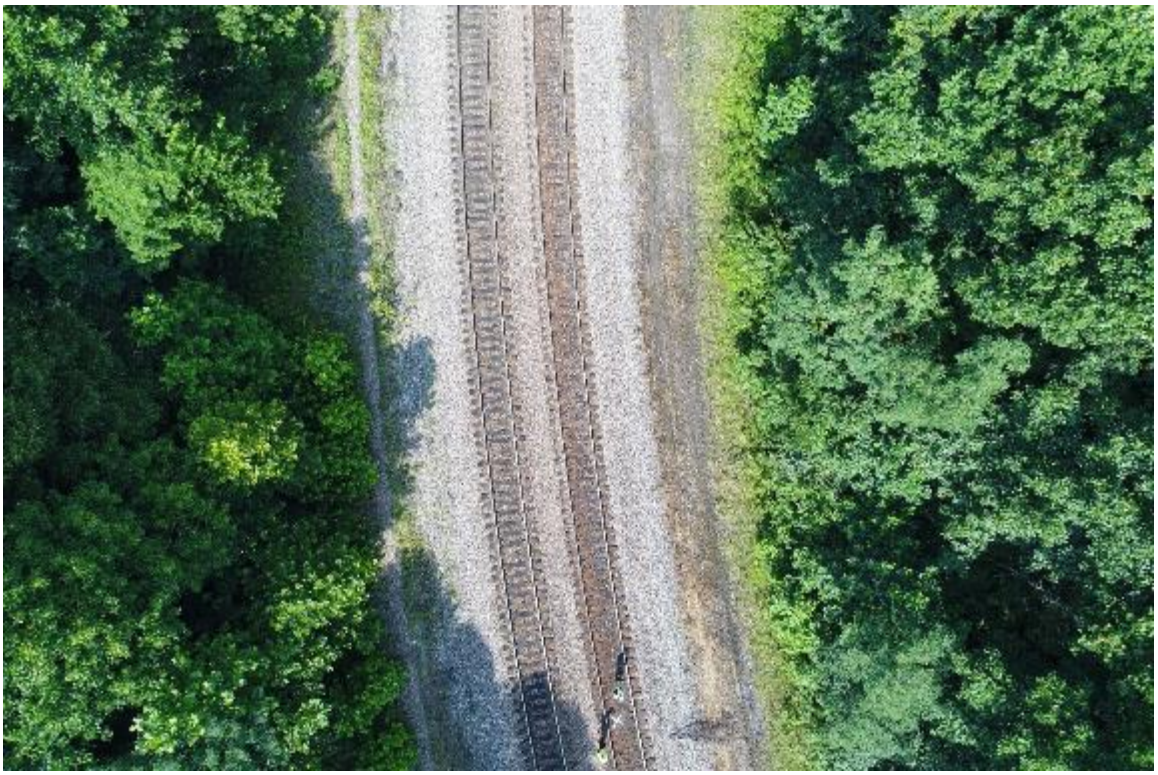

Figure 7 – Sample photo of intial point and witness marks

Attachment 6 is the orthomosaic of the day 1 section of rail in kmz format, attachment 7 is the sample photo in full resolution.

A number of sorties were flown to video document the removal of the protective jacket from a burning liquid propane gas (LPG) tank car under the direction of a CSX hazmat specialist. The video files are in the docket as attachments 8 and 9, an exemplar snapshot is shown in figure 8.

Figure 8 – Snapshot of jacket peel video

On the second day, the remainder of the rail section leading to the grade crossing and main wreckage area was documented. Figure 9 is an overview of the rail map, and figure 10 is an excerpt in the area of the grade crossing. Attachment 10 is the orthomosaic export in kmz format.

Figure 9 – Overview of rail map day 2

Figure 10 – Excerpt of orthomosaic at grade crossing

Figure 11 and attachment 11 are a sample source photo in the area of the grade crossing.

Figure 11 – Source photo in area of grade crossing

Numerous cars had been removed from the main wreckage site by day 2, sorties were flown to document and model the area of the main wreckage forward to the trestle where the initial derailed car had stopped. Figure 12 is a sample snapshot of the 3D model looking toward the trestle, attachment 12 is a virtual fly-through of the 3D model.

Figure 12 – Excerpt of wreckage 3D model day 2

Figure 13 and attachment 13 are a sample full resolution source photo of the main wreckage area on day 2.

Figure 13 – Source photo main wreckage day 2

3.0 Attachments

Attachment 1 – Day 1 Wreckage Google Earth kmz export

Attachment 2 – Day 1 3D model virtual fly-through

Attachment 3 – Day 1 3D model OBJ format

Attachment 4 – Day 1 Wreckage sample source photo

Attachment 5 – Day 1 Wreckage sample source photo

Attachment 6 – Day 1 Rail Google Earth kmz export

Attachment 7 – Day 1 Rail sample source photo

Attachment 8 – Video of jacket peel 1

Attachment 9 – Video of jacket peel 2

Attachment 10 – Day 2 Rail Google Earth kmz export

Attachment 11 - Sample source photo, grade crossing

Attachment 12 - Day 1 3D model virtual fly-through

Attachment 13 – Sample source photo wreckage area Day 2