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

UAS Aerial Imagery Report

11/12/2019

A. ACCIDENT PLD19FR002

Location:	Danville, Ky
Date:	Aug 1, 2019
Time:	1224 Local Time (EDT)
Event:	Gas line explosion

B. PERSONNEL

UAS RPIC:	Bill English NTSB UAS Program Lead Washington DC

C. ACCIDENT SUMMARY

A summary of this accident is contained in the docket.

D. DETAILS OF IMAGERY

1.0 Equipment and Procedures

Equipment

Flights to photo-document and map the area of the explosion were conducted on August 3 and 4, 2019, using one of the NTSB DJI Phantom 4 Advanced small unmanned aircraft systems (sUAS, or 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, the camera is capable of video resolution of 4K HD up to 120 frames per second.

Ground control points (GCP) were taken with a Trimble GEO7X differential GPS receiver throughout the area.

Procedures

The accident site was in a field adjacent to a small rural residential area. Airspace was Class G, approximately 3.5 miles from a small non-towered airport. There were no

airspace, terrain, or obstruction hazards. Environmental hazards in the area were soot from the post-explosion fire, residual natural gas, dislodged shale, and heavily damaged buildings. The flight was conducted under 14 CFR 107. Weather conditions were good VFR.

The drone was flown in overlapping grids at 250 feet above ground level (agl) over the entire accident site capturing still images to create a 3D orthomosaic map of the blast pattern and debris. Smaller grids at 175, 100 and 50 feet were flown over the crater and ejected section of pipe for greater detail as well as to depict and calculate the volume and contours of the crater. Additional still photos and video for overview purposes were taken.

Approximately 1500 high resolution photos and videos were gathered. Total mission time including set-up, gathering ground control points, flights, and initial processing was 10 hours over the 2-day period.

2.0 Processing and Products

Processing

The GCPs were processed using the Continuously Operating Reference Station (CORS) at the Kentucky School for the Deaf, Danville, KY (KYDV) resulting in a positional accuracy of approximately 5 cm.

Still imagery was processed using Pix4D photogrammetry software in two different projects, one to focus on an overall orthomosaic map of the site, and another more detailed 3D point cloud and map of the explosion crater. Relative accuracy within the overall map was calculated at 1.44 inches, (twice the average ground sample distance), relative accuracy within the detailed crater point cloud was calculated at 0.78 inches.

Imagery products

The overall orthomosaic map was output in both geo-tiff and Google Earth formats. The crater was output as both point cloud and orthomosaic to allow for detailed measurements as well as contour and volume calculations.

Figure 1 depicts an overhead photograph of the accident area with select measurements taken from the orthomosaic map.

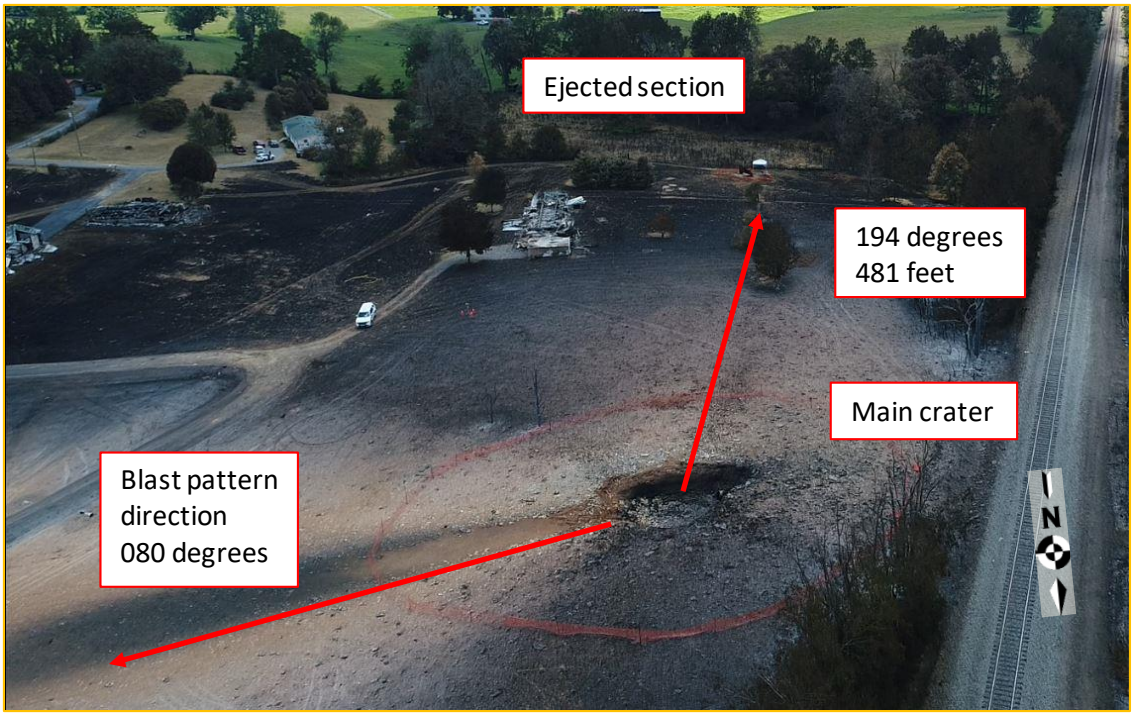

Figure 1 – Aerial view of overall site with select measurements

Figure 2 is a snapshot from the Google Earth orthomosaic map. The burned area encompasses approximately 30 acres, including grass fire area on the far side of the railroad tracks. The areas of damaged buildings are annotated with approximate distance from the crater.

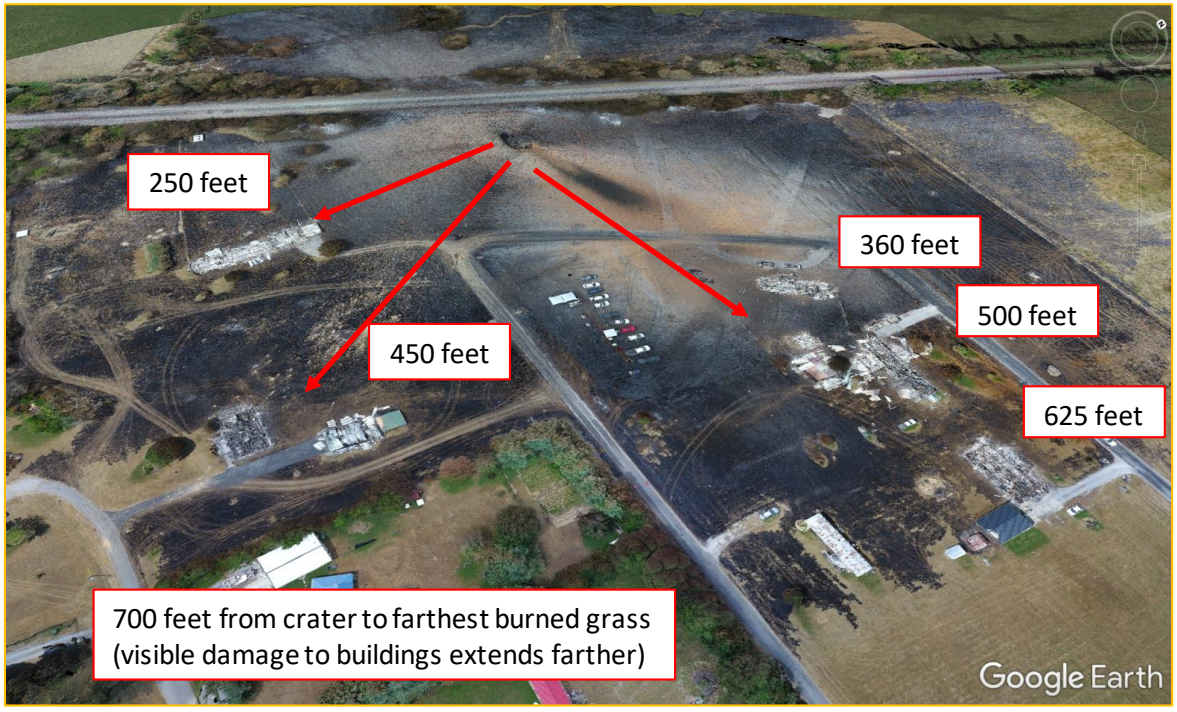

Figure 2 – Snapshot from Google Earth orthomosaic

Figure 3 is a view from the overall 3D point cloud depicting the resting location of the ejected section of pipe. The section came to rest 481 feet from the crater (measured from center to center), in a hollow about 16 feet below the level of the crater.

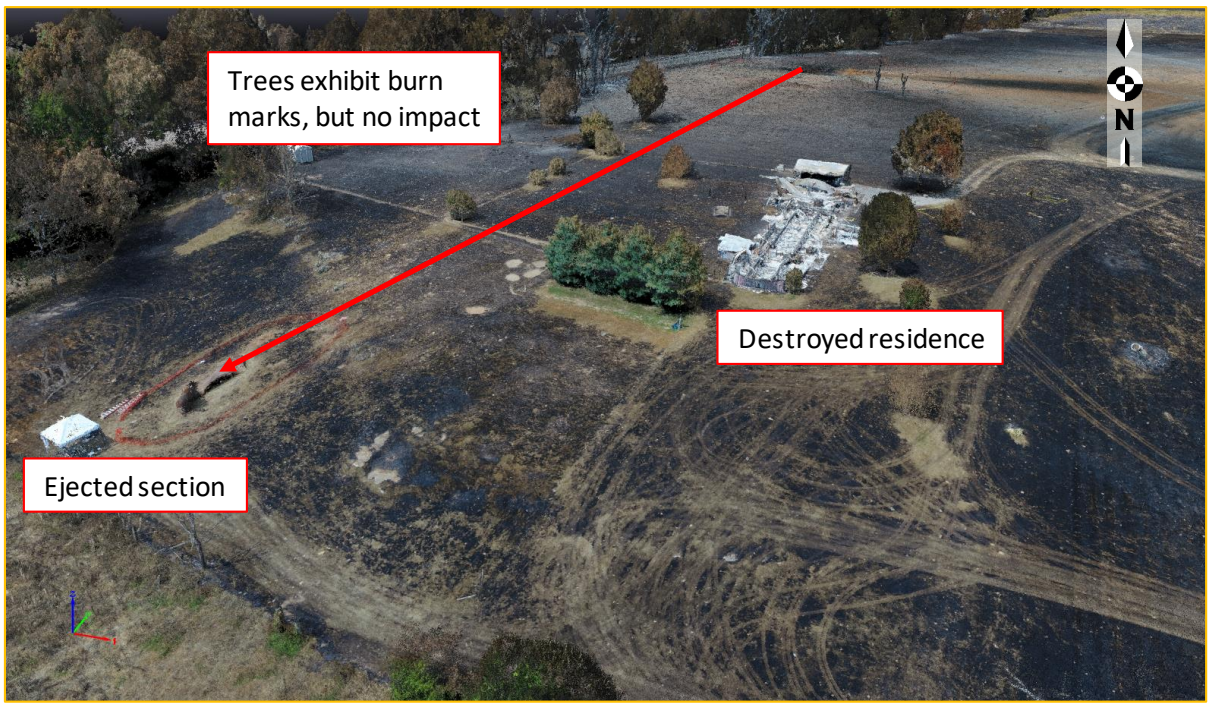

Figure 3 – 3D point cloud of site

Figure 4 is closer overhead view of the ejected section, showing the alignment and ground scars consistent with a vertical component of impact.

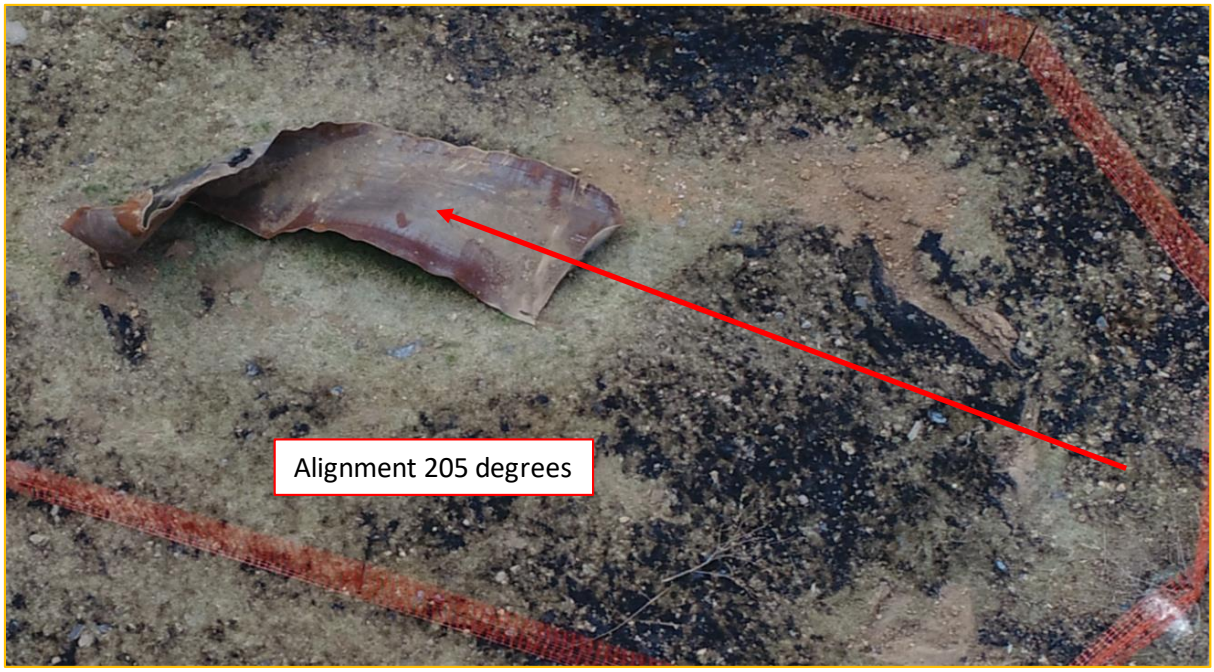

Figure 4 – Ejected section of pipe

Figure 5 is a view of the point cloud with measurements of the missing section of pipe.

Figure 5 – Oblique point cloud view of main crater with measurements of pipe

Figure 6 is directly overhead, indicating the dimensions of the crater.

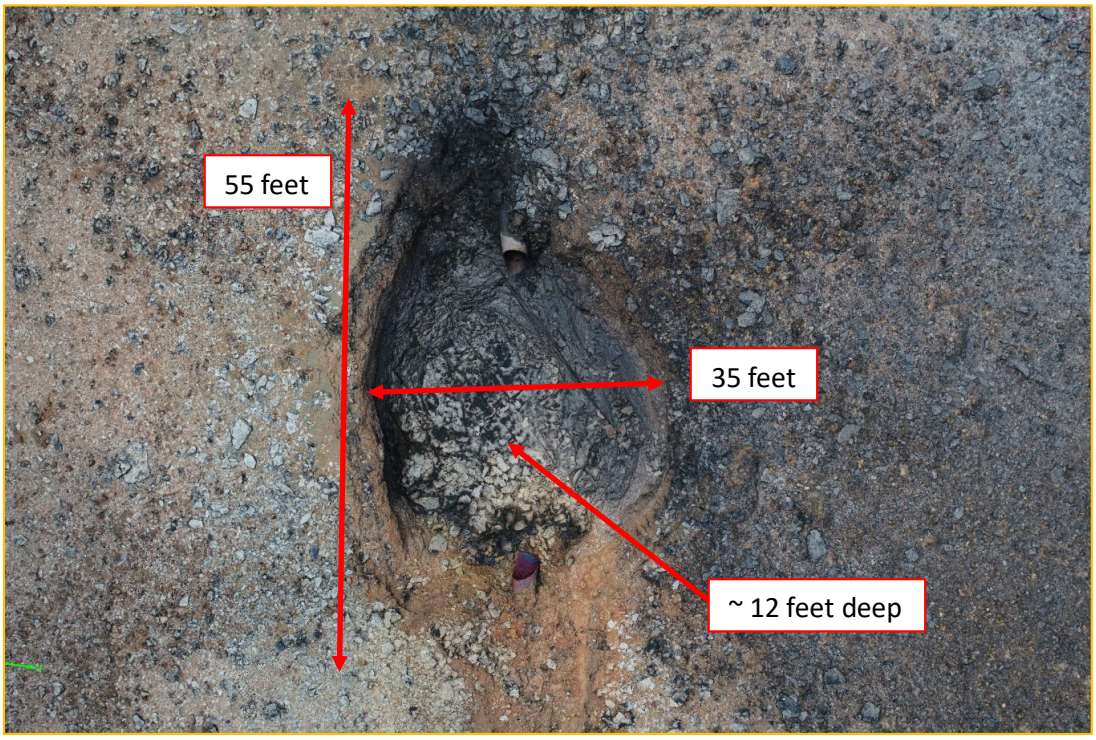

Figure 6 – Overhead point cloud view of main crater with dimensions

E. ATTACHMENTS

1.0 Video of Ejected Section area
2.0 Video of Crater and Houses
3.0 Orthomosaic Map Google Earth format
4.0 Orthomosaic Map Geotiff format
5.0 Point Cloud of Crater xyz format