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

UAS Aerial Imagery Report

11/16/2018

A. ACCIDENT ERA18FA167

Location:	Springfield Township, NJ
Date:	June 13, 2018
Time:	0908 Local Time (EDT)
Event:	BE58 N218BL

B. PERSONNEL

UAS RPIC:	Bill English National Transportation Safety Board Washington, D.C.

C. ACCIDENT SUMMARY

On June 13, 2018, about 0908 eastern daylight time, a Beech 58, N218BL, impacted a field while in a right wing and nose low attitude near Springfield Township, New Jersey. The private pilot and private-rated passenger were fatally injured, and the airplane was destroyed by impact forces. The airplane was owned and operated by a private individual under the provisions of Title 14 Code of Federal Regulations (CFR) Part 91. Day instrument meteorological conditions prevailed, and an instrument flight rules (IFR) flight plan was filed for the positioning flight, which originated from South Jersey Regional Airport, Mount Holly, New Jersey, about 0904, and was destined for Barnstable Municipal Airport-Boardman/Polando Field (HYA), Hyannis, MA.

D. DETAILS OF IMAGERY

1.0 Equipment and Procedures

Equipment

Mapping and viewpoint flights of the wreckage area were conducted on June 13, 2018, using the NTSB DJI Phantom 4 Professional small UAS (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 size is 20 megapixels in JPG or RAW format. Videos were taken in MP4 format with 4K resolution at 60 frames per second.

Ground control points (GCP) and significant wreckage locations were taken with a Trimble GEO7X differential GPS receiver.

Procedures

The accident site was in Class G airspace. The accident area was farm fields and a treelined road. Flights were conducted under the provisions of 14 CFR Part 107. No significant hazards to flight were in the area.

The sUAS was flown in an overlapping double grid over the impact area at 125 feet above ground level. Video overviews were taken along the flight path. Video was used in real time to search back along the path toward the departure airport for any additional witness marks or aircraft components (none were seen). Additional oblique and panoramic stills were taken for overview and further detailed mapping. Total mission time was approximately three hours including prep, flight time, and initial processing.

Processing

DGPS data was corrected using the continuously operating reference station (CORS) at Taylor Wiseman, NJ (NJTW). DGPS data was used to supply ground control points for photogrammetry and to document significant portions of the wreckage. Elevation and positional accuracy (to features outside the map) was measured to within 3.6 inches.

Geo-referenced still imagery was processed using Pix4D photogrammetry software to produce a 3D point cloud and an orthomosaic map of the wreckage site. Relative accuracy (within the map) was calculated at 0.9 inches (twice the ground sample distance.) The orthomosaic map was exported in Google Earth kmz format. The full file is in the docket for this accident, excerpts with select measurements are included in this report.

The 3D point cloud product was processed using point cloud classification, allowing different categories of objects to be disabled from view within the software. Removing the "high vegetation" class from view, aided the visualization of aircraft component trajectories. The classified point cloud is included in the docket. Video "fly throughs" of the point cloud, both with and without the high vegetation are included in the docket.

Video along the flight path and wreckage area was edited for length and included in the docket in full 4K resolution.

2.0 Imagery products

Approximately 390 high resolution photos and videos were gathered. Select source photos, excerpts from the orthomosaic map, and snapshots from the low resolution orthomosaic are shown below. Figure 1 is a view from the north looking toward the initial impact marks and ground scar. The curve of the ground scar is toward the east, and broken trees and wreckage indicate the aircraft passed through the treeline and across the road in an easterly direction.

Figure 1 – Initial Impact mark

Figure 2 is a photo looking back along the direction of impact at the resting points of significant wreckage that passed across the road and through the opposite treeline.

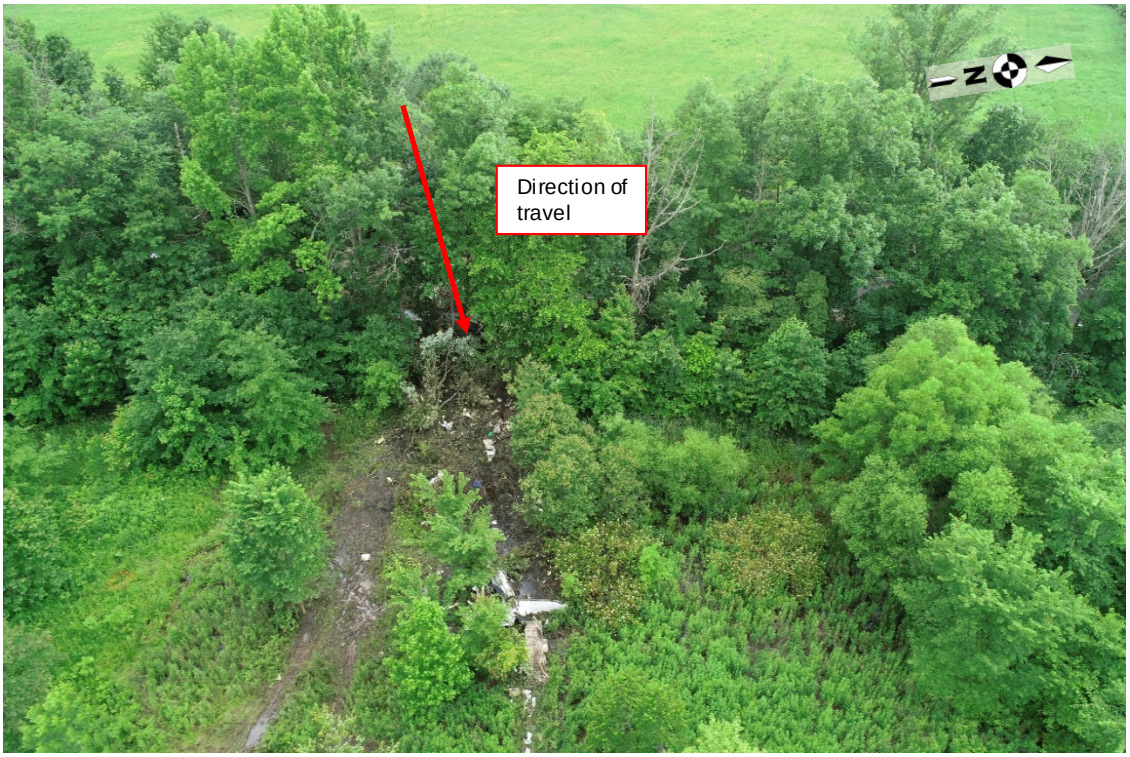

Figure 2 – Main wreckage looking back along direction of impact

Figure 3 is a snapshot of a Google Earth overlay of the orthomosaic wreckage map (Attachment 2). Significant portions of wreckage, distances and directions are indicated. The Attachment 2 file can be opened in Google Earth and other measurements can be made.

Figure 3 – Google Earth wreckage map

Figure 4 is a snapshot of the overall 3D point cloud of the wreckage area. The point cloud can be rotated in any direction along 3 axes, and precise measurements can be made between marked points in the source photos.

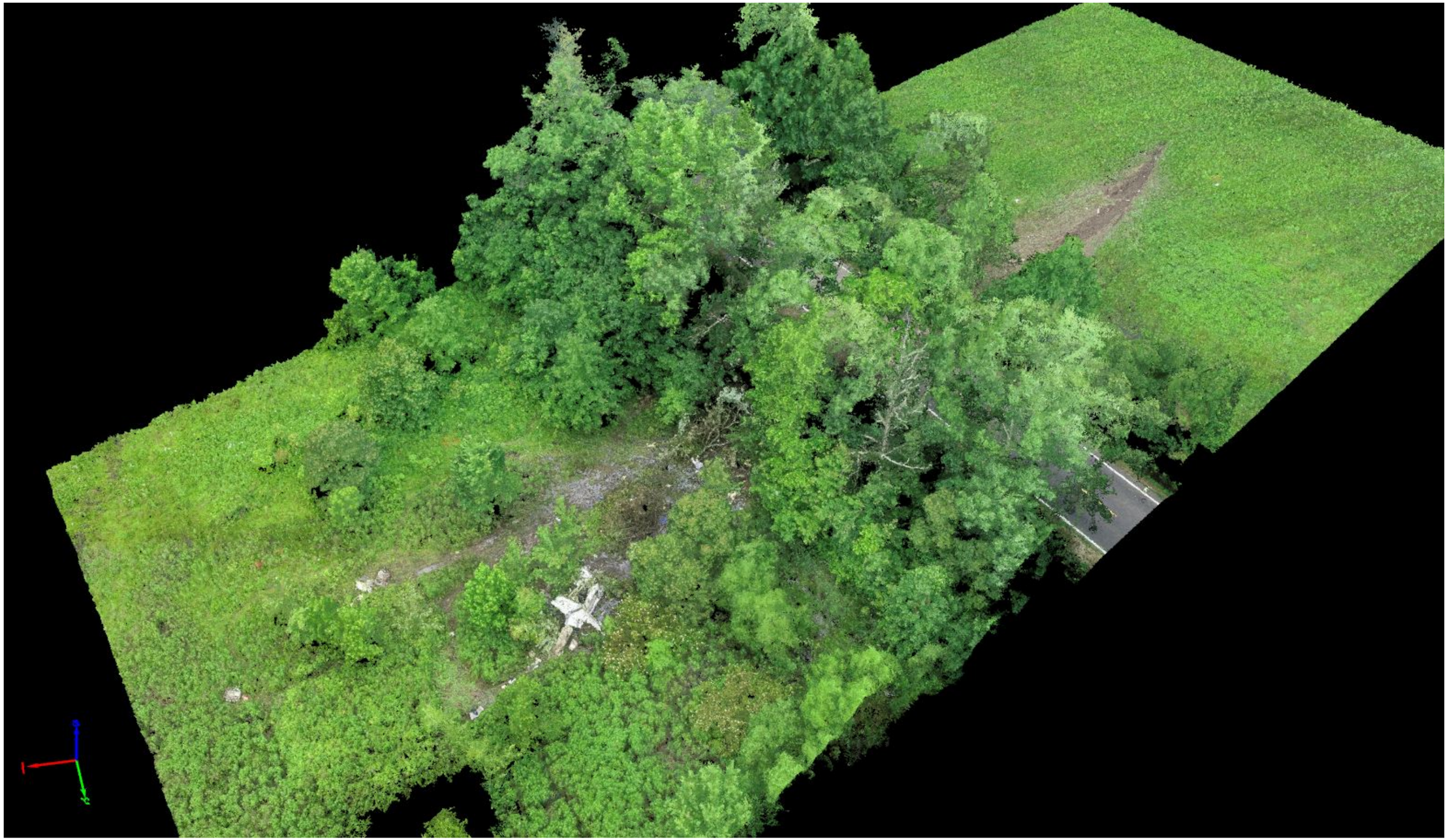

Figure 4 – Still snapshot of point cloud overall

Figure 5 is a closeup of one of the source photos of the ground scar. The area circled indicates an area of ground that appeared to be solid enough to make a reasonable measurement of the angle of the side of scar consistent with the lower surface of the airplane's right wing, a piece of which is nearby. Much of the initial part of the scar was soft and muddy, or covered with long grass. The checkerboard is one of the DGPS ground control points.

Figure 5 – Closeup of sample photo of impact ground scar

Figure 6 is a measurement between two selected points that appeared to be consistent with a stable area of ground accurately reflecting the bank angle at impact. The length of the line between the two points is 0.35 meters, the elevation difference is 0.17 meters, resulting in an angle of approximately 29 degrees. Note, this measurement is subject to the precision errors of the photogrammetry processing and should be taken as an estimate only.

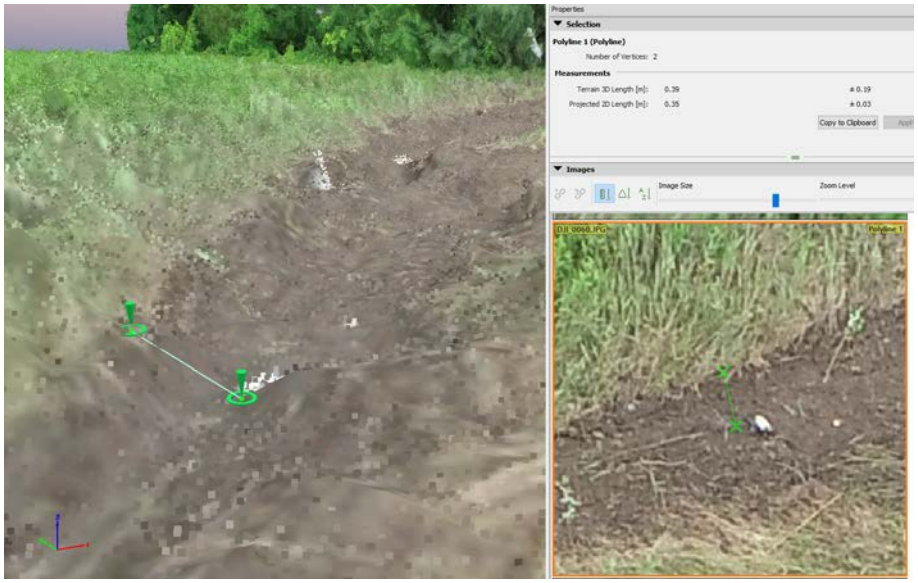

Figure 6 – Point cloud measurement of impact mark angle

Using the standard turn radius formula $R= V^2/G*\tan\theta$, entering the 860 foot radius from figure 3, and bank angle of 29 degrees from figure 6, resulted in a ground speed of 73 knots. The source orthomosaic and point cloud are available in the docket for validation.

ADS-B surveillance data was obtained from the FAA and overlaid on a basemap along with the orthomosaic. Green symbols were tagged as valid data in the ADS-B file, red symbols were returns tagged as invalid. The white line is an estimation of the flight path based on aligning the ground scar, valid ADS-B returns, and an assumed fit around the invalid returns.

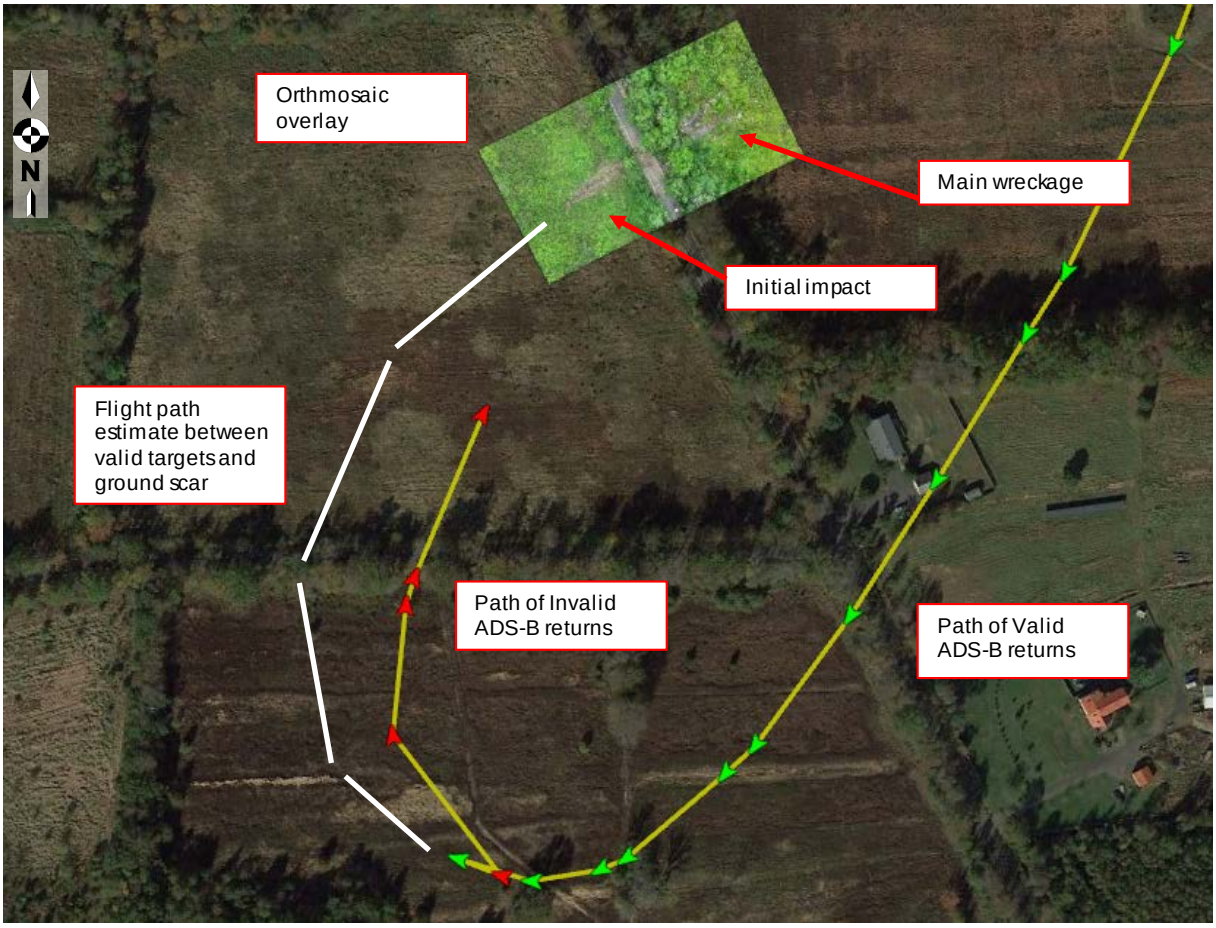

Figure 7 – Orthomosaic and ADS-B returns plotted on common basemap

Attachment 1 – Select source photos

Attachment 2 – Google Earth kmz

Attachment 3 – Point Cloud las format

Attachment 4 – Video along flight path

Attachment 5 – Video main wreckage

Attachment 6 – Point cloud fly-through videos