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

UAS Aerial Imagery Factual Report

1/16/2018

A. ACCIDENT CEN18FA053

Location:	Oldenburg, Indiana
Date:	December 16, 2017
Time:	2100 Eastern Standard Time (EST)
Event:	N761YZ C210

B. PERSONNEL

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

C. ACCIDENT SUMMARY

On December 16, 2017, about 2058 eastern standard time, a Cessna T210M airplane, N761YZ, impacted trees and terrain following a reported loss of engine power near Oldenburg, Indiana. A postimpact fire ensued and the airplane was destroyed. The pilot, pilot-rated passenger, and passenger were fatally injured. The airplane was registered to N761YZ LLC and operated by the pilot as a 14 Code of Federal Regulations Part 91 personal flight. Night visual meteorological conditions prevailed. The flight was operated on an instrument flight rules flight plan and originated from the Columbus Municipal Airport (BAK), Columbus, Indiana, about 2039. The intended destination was the Frederick Municipal Airport (FDK), Frederick, Maryland.

D. DETAILS OF IMAGERY

1.0 Equipment and Procedures

Equipment

Mapping flights of the wreckage area were conducted on December 18, 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 photo and video documentation of the Batesville airport closed runway, and point of view from the last radar returns were conducted on December 18, 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 30 frames per second.

Select points in the wreckage area were documented with a Trimble GEO7X differential GPS receiver.

Procedures

The accident site was in Class G airspace, no airspace authorization was required, and the flight was conducted under 14 CFR 107. The wreckage area was in an unpopulated hilly wooded area with bare deciduous trees approximately 80 feet tall, and a small stand of evergreens adjacent to the impact path. The Batesville airport was closed and airport personnel approved the flights. Point of view at the last radar return area was over unpopulated farmland. Fog and mist conditions were in the area, so flights were conducted during periods of acceptable visibility and no precipitation.

The Phantom 4 Pro was flown in an overlapping grid over the main wreckage area at 180 feet above home point to ensure clearance from tall trees and effective overlap. The takeoff/home point was an elevated berm northwest of the main wreckage site to allow maximum line of sight visibility. The Inspire was hand-flown along the runway from each approach end to cover the red X markings and equipment parked on the runway at an altitude of 150 feet to approximate the view from short final. A 360 degree scan of stills from the location of the last radar return was taken at 300 feet, approximately the altitude of the airplane based on FAA ADS-B returns supplied by the NTSB ATC specialist. Total flight time using both drones was approximately 1 hour.

Processing

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 1.44 inches, twice the ground sample distance.

DGPS data was corrected using the continuously operating reference station (CORS) at Greenburg, Indiana. DGPS data was used to correct elevation and provide checkpoints for accuracy, conditions and time did not allow for optimal placement of ground control points. Elevation was corrected to 44 inches, positional accuracy (to features outside the map) was measured to 24 inches.

2.0 Imagery products

Approximately 550 high resolution photos and videos were gathered. Still photos, videos, and the initial low-resolution map were provided to the IIC on scene. Full resolution maps and other products are included in this document and in the docket.

Figure 1 is a still photo overview of the main wreckage area. Figure 2 is a still photo overview of the initial tree strike and right wingtip lodged in a tree. The source photos are Attachment 1 and 2.

Figure 1 – Main wreckage area

Figure 2 – Initial Impact and Right Wingtip

Figure 3 is a wreckage site diagram based on the full resolution orthomosaic Google Earth kmz export. The kmz file is Attachment 3.

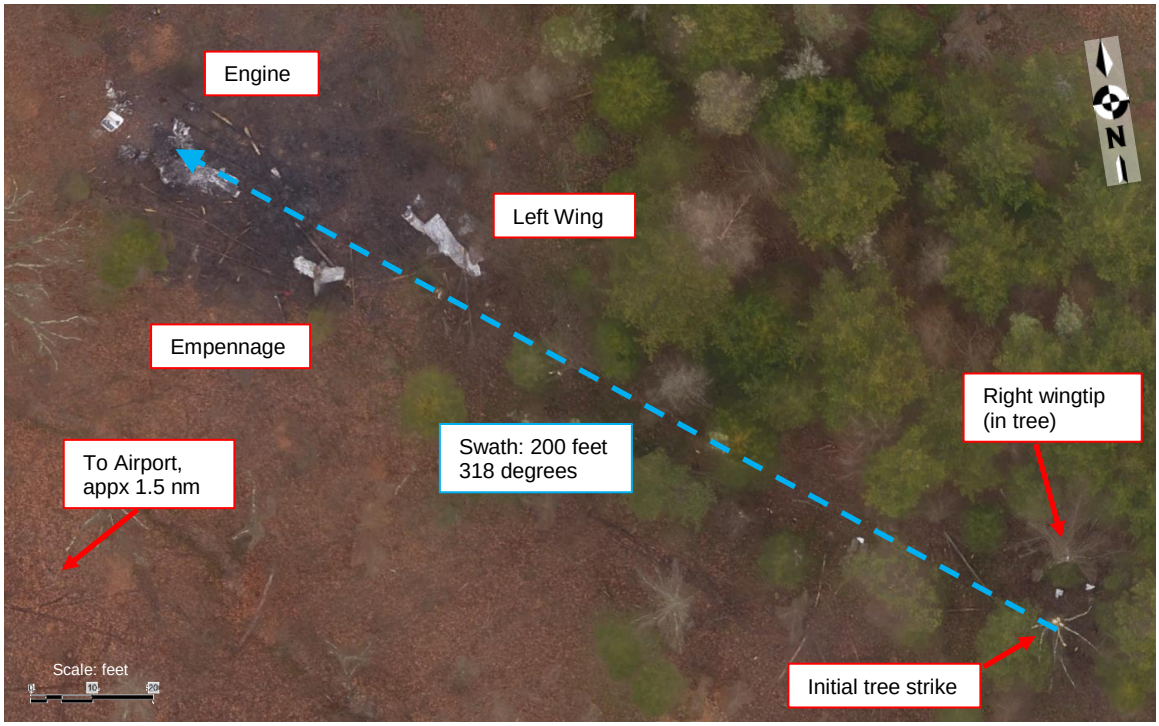

Figure 3 –Google Earth orthomosaic map

The Pix4D point cloud (attachments 4 and 5) was used to measure the angle between significant tree strikes in high locations along the main swath. The angle along the higher strikes was measured at 2.2 degrees. (Figure 4 and Table 1)

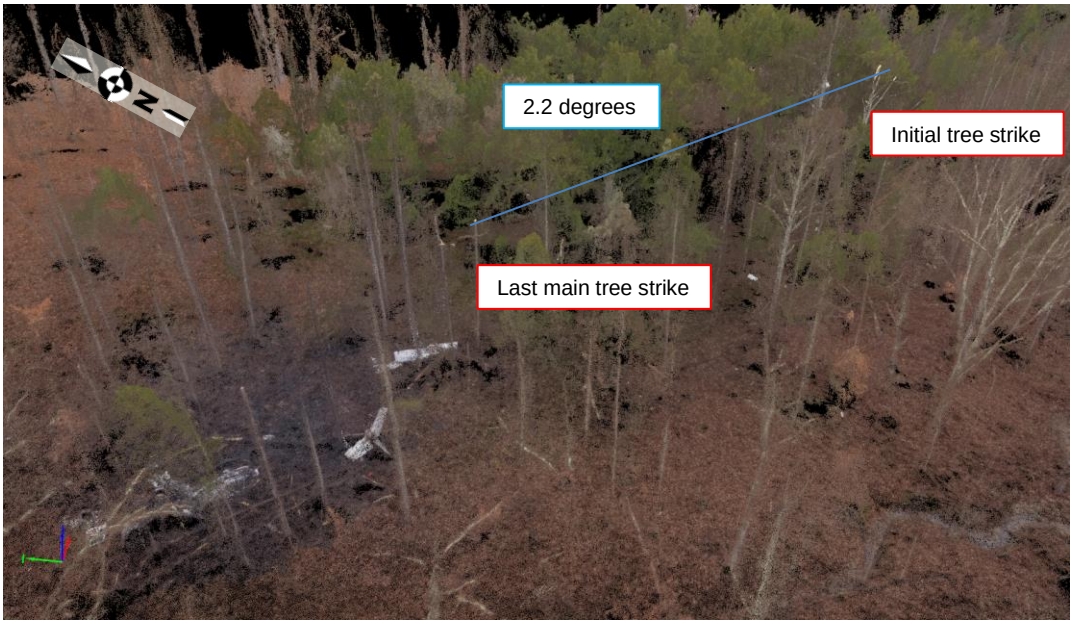

Figure 4 – 3D Point Cloud measurement of tree strike angle

The point cloud also displayed intermediate tree strikes consistent with the path of the empennage after separation. Figure 5 indicates marked points of tree strikes and major portions of wreckage. Figure 6 is the same view with high vegetation removed via point cloud classification.

Figure 5 – 3D Point Cloud showing intermediate tree strike witness marks

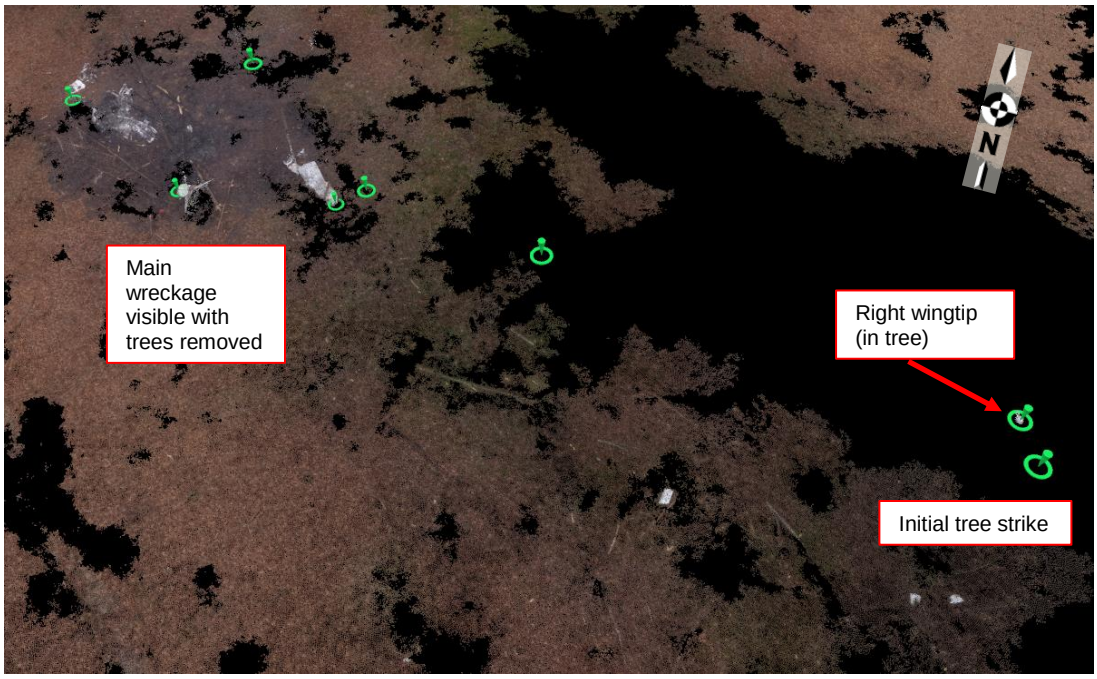

Figure 6 – 3D Point Cloud with "high vegetation" classification removed

Point cloud classification also aided in mapping the elevation and contours of the underlying terrain, with trees removed). A digital terrain map was generated with false color and overlaid with the orthomosaic onto a GIS basemap. (Figure 7 and Attachment 6)

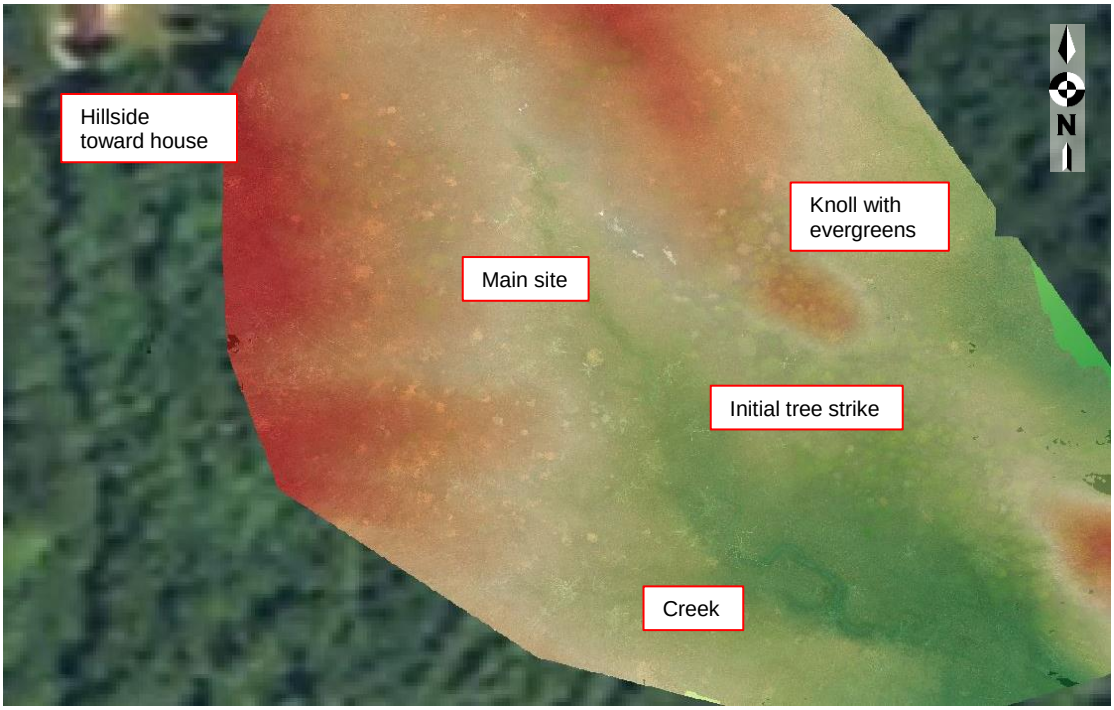

Figure 7 – Digital terrain model overlaid with orthomosaic and basemap

ATC radio communications indicated the pilot was attempting to land at Batesville airport, which was NOTAM'd closed. Photo documentation of the runway X markings and equipment placed on the runway was taken during daytime, from the approximate altitude of an airplane on short final (Figure 8 and Attachment 7).

Figure 8 – View of Runway 18 showing X and equipment

Photo documentation was also taken from the approximate location between the last two ADS-B ATC returns (Figure 9 and Attachment 8). Figure 10 is a combined map of the ADS-B returns and the orthomosaic, with a sectional chart overlay.

Figure 9 – View from last radar targets position/altitude/track looking along Stockpile Rd.

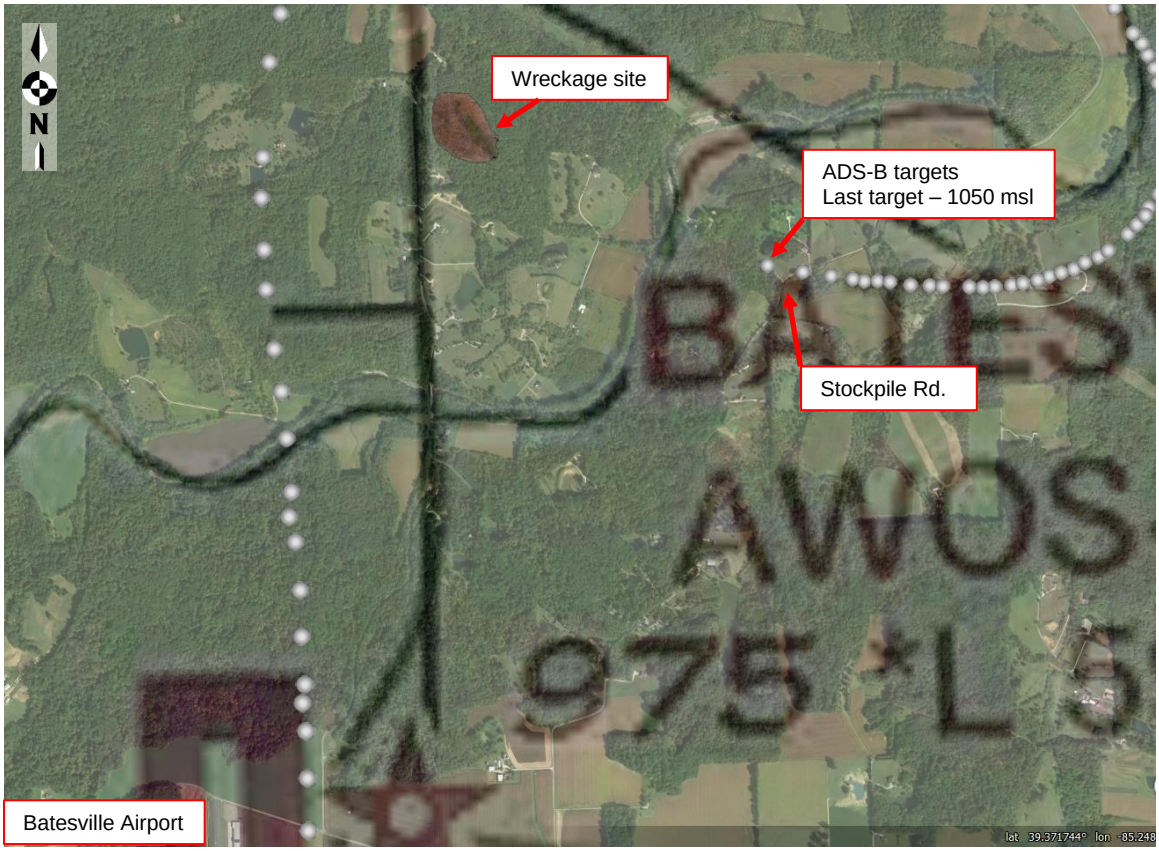

Figure 10 – ADS-B and Sectional overlaid on Google Earth with orthomosaic

Table 1 – Features – from point cloud

Feature	Lat	Long	Elevation (ft msl)
Initial tree impact	39.37205463	-85.24756678	900.1
Right Wingtip (in tree)	39.37208432	-85.24754298	891.2
Tree Strike 2	39.37216811	-85.24775339	901.7
Tail tree strike	39.37226720	-85.24783953	882.4
Last tree strike (main swath)	39.37232804	-85.24789923	894.8
Right Elevator	39.37236622	-85.24798595	853.1
Left wing tip	39.37232817	-85.24786795	857.4
Engine (Moved/map position)	39.37245194	-85.24807317	855.5

Distance from initial tree impact to last tree strike (main swath) – 137.6 feet.
Elevation difference between initial and last tree strikes – 5.3 feet, angle – 2.2 degrees

ATTACHMENTS

Attachment 1 – Photo of main wreckage

Attachment 2 – Photo of initial tree strike

Attachment 3 – Google Earth tiles KMZ format

Attachment 4 – 3D point cloud fly through video

Attachment 5 – 3D point cloud LAS format

Attachment 6 – Digital terrain map

Attachment 7 – Photo of Batesville runway

Attachment 8 – Viewpoint photo from area of last ADS-B returns