

# **NATIONAL TRANSPORTATION SAFETY BOARD**

Office of Aviation Safety  
Washington, D.C. 20594

## **UAS Aerial Imagery Report**

7/10/2018

### **A. ACCIDENT ERA18FA127**

Location: Crozet, VA  
Date: April 15, 2018

### **B. PERSONNEL**

UAS RPIC<sup>1</sup>: Michael Bauer  
National Transportation Safety Board  
Washington, D.C.

### **C. ACCIDENT SUMMARY**

On April 15, 2018, at 2054 eastern daylight time, a Cessna 525, N525P, was destroyed after it impacted terrain near Crozet, Virginia. The private pilot was fatally injured. The flight was operated by an individual under the provisions of Title 14 Code of Federal Regulations Part 91 as a personal flight. Night instrument meteorological conditions prevailed, and there was no flight plan filed for the flight, which departed Richmond Executive – Chesterfield County Airport (FCI), Richmond, Virginia, around 2035, and was destined for Shenandoah Valley Regional Airport (SHD), Weyers Cave, Virginia.

### **D. DETAILS OF IMAGERY**

#### **1.0 Equipment and Procedures**

##### **Equipment**

Mapping flights of the wreckage area and inspection flights to collect photo and video documentation were conducted on February 1, 2018 and February 2, 2018, using the NTSB DJI Phantom 4 Professional (P4P) 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. One video was taken in MP4 format, with 4K resolution at 60 frames per second.

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<sup>1</sup> RPIC – Remote Pilot In Command

Ground control points, and significant wreckage locations 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 contained in an unpopulated steep sloped (~25% grade) wooded area with bare conifer and deciduous trees approximately 60-70 feet tall, and a small stand of evergreens adjacent to the impact path. Weather conditions were clear with less than 10 knot winds. The purpose of the UAS imagery was to document the wreckage site and collect still images around the area.

The sUAS was flown in overlapping grids over the main wreckage sites capturing still images to create an orthomosaic terrain map. The grids were flown at two different constant altitudes. An additional set of grids was flown utilizing a constant above ground level altitude (150ft and 200ft AGL). Additional panoramic photos were taken to create images above the wreckage to provide situational awareness in the vicinity of the wreckage. Total flight time was approximately 1 hour and 14 minutes.

## **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 1.12 inches, twice the average ground sample distance.

DGPS data was used to correct for any UAS elevation data errors and provide positional data for ground control points and checkpoints. DGPS data was corrected using the continuously operating reference station (CORS) at Fan Mountain, VA (UVFM). Horizontal and vertical positional accuracy (when compared to features outside the 3D point cloud) was calculated at 15.7 inches horizontally and 23.6 inches vertically.

## **2.0 Imagery products**

Approximately 800 high resolution photos and one video were gathered. Select photos, snapshots from video, and excerpts from the 3D point cloud are included in this report in section 4.0. A list of images and select output products attached to this report and contained in the docket are listed in section 3.0.

Figure 1 and Figure 2 are still images showing a general overview of the main wreckage area at the accident scene. Multiple damage trees are highlighted around the area of the main impact crater. The energy path of the wreckage was estimated to be on a 106° heading from the Google Earth Mosaic. Although not shown in the imagery, the farthest piece of wreckage visible in the sUAS imagery from the main impact site was measured in Pix4D to be approximately 351 ft (107 m) away from the impact crater.

Figure 3 is a still image showing the trees that had trunk and branches separated during the aircrafts' descent. Multiple severed branch locations are noted. Utilizing data from the point cloud, the aircrafts' angle of descent was approximately 71° relative to the horizon.

Figure 4 and Figure 5 contain screenshots of the orthomosaic map in Google Earth .kmz format. Figure 4 shows the overall accident site with showing the general direction of the energy path and the extent of smaller wreckage pieces. Figure 5 is an enlarged image around the main wreckage area.

Figure 6 is a screenshot of the three-dimensional point cloud generated from the aerial imagery flights by the sUAS.

Figure 7 is a sample of the panoramic view of the overall accident scene. The image was created using commercially available software which stitched together 34 individual images taken using a programmed sequence from the drone control software. The product is intended to be used with a 360 Panoramic viewer software and it is projected onto 2D for this report, creating various distortions. The original panoramic image is an attachment to this report and located in the accident docket.

### **3.0 Attachments**

**Attachment 1** – Original Photograph used in Figure 1

**Attachment 2** – Original Photograph used in Figure 2

**Attachment 3** – Original Photograph used in Figure 3

**Attachment 4** – Orthomosaic map in Google Earth .kmz format (ref. Figure 4 and Figure 5)

**Attachment 5** – Panoramic Image shown in Figure 7

4.0 Oversized Imagery



Figure 1 – Photo – Aerial view of main wreckage area, energy path towards top of page (directional arrow approximated)



Figure 2 – Photo - Aerial view of main wreckage area, energy path towards bottom of page (directional arrow approximated)

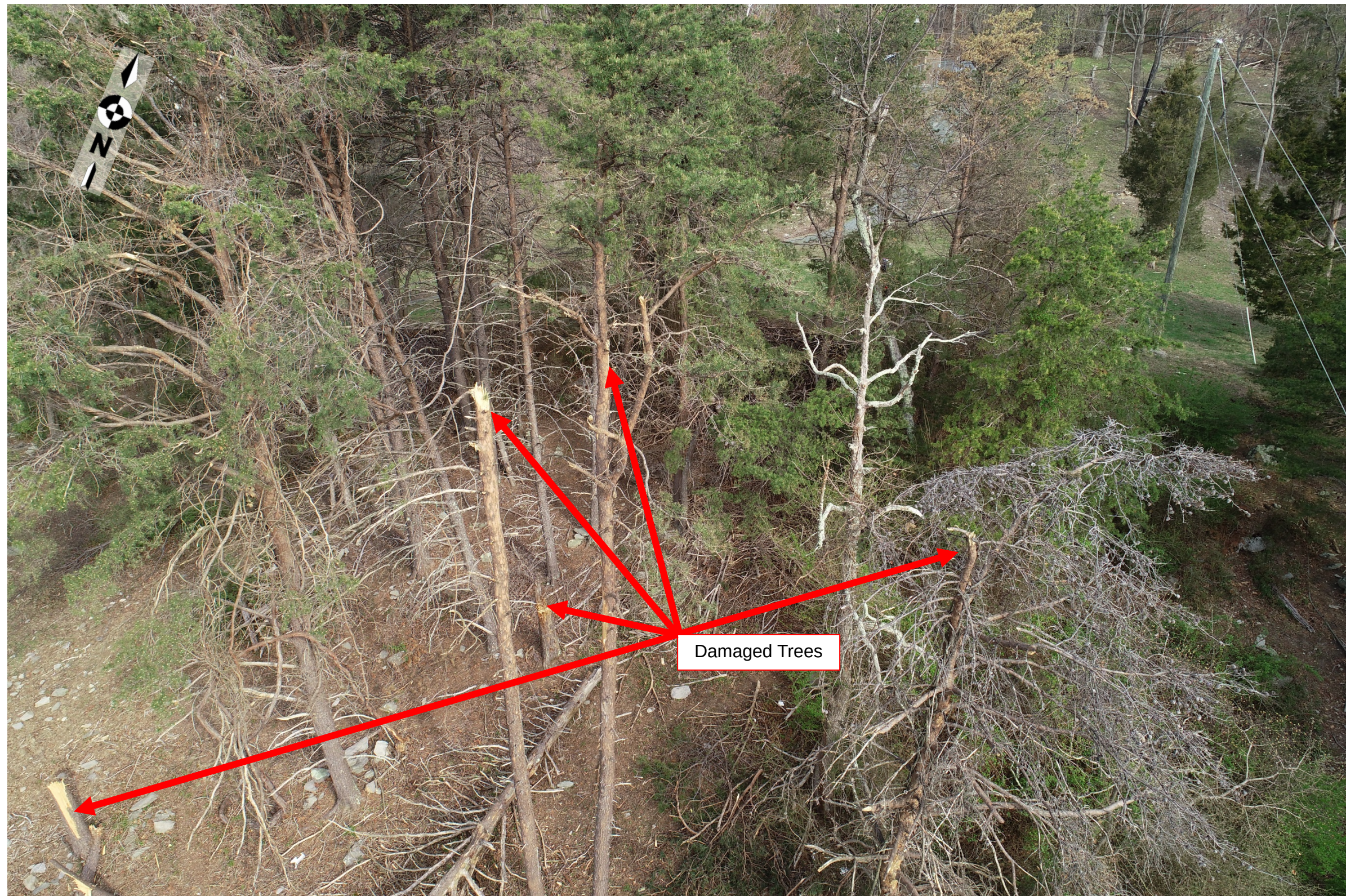


Figure 3 – Photo - Aerial view of damaged trees around main wreckage site, impact crater and energy path off the bottom of page and is not shown (directional arrow approximated)



Figure 4 – Orthomosaic of accident site overlaid on Google Earth



Figure 5 – Orthomosaic of accident site overlaid on Google Earth zoomed in to show main wreckage area.

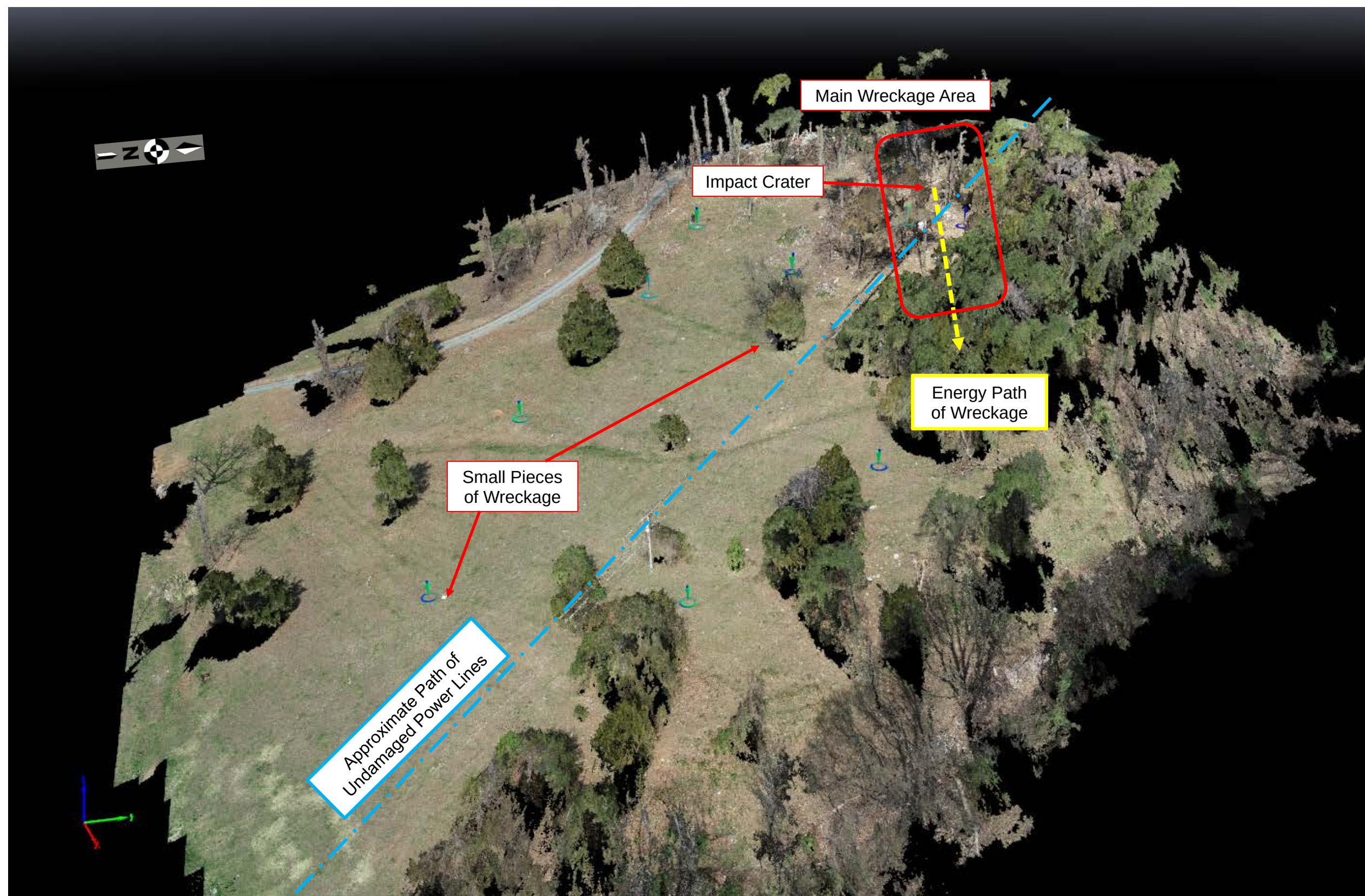


Figure 6 - View of the processed point cloud from Pix4D, Green/Blue markers are ground control points used in software



Figure 7 - Panoramic image of scene reconstruction (Image contains distortions)<sup>2</sup>.

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<sup>2</sup> The image is intended to be viewed with 360 Panoramic viewer software and it is projected onto 2D for this report, creating various distortions (i.e. roadway/power-line curvature).