

NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

UAS Aerial Imagery Report

9/06/2018

A. ACCIDENT WPR18FA200

Location: Sheboygan, Wisconsin

Date: July 20, 2018

B. PERSONNEL

UAS RPIC¹: Michael Bauer
National Transportation Safety Board
Washington, D.C.

C. ACCIDENT SUMMARY

On July 20, 2018, about 1604 central daylight time, a De Havilland DH112 Venom airplane, N747J, impacted a structure shortly after takeoff near Sheboygan, Wisconsin. The pilot was fatally injured. Two people in the structure sustained serious injuries. The airplane was destroyed during a post impact fire. The airplane was registered to World Heritage Air Museum and operated by the pilot as a Title 14 Code of Federal Regulations Part 91 personal formation training flight. Visual meteorological conditions prevailed about the time of the accident, and no flight plan was filed. The flight was originating at the time.

D. DETAILS OF IMAGERY

1.0 Equipment and Procedures

Equipment

Mapping and viewpoint flights of the accident site were conducted on July 22, 2018, using the NTSB DJI Phantom 4 Professional (P4P) small unmanned aircraft system (sUAS, commonly known as a drone). The drone was equipped with a dual GPS/GLONASS receiver which provided georeferenced information on all still photos. The drone was equipped with an FC6310 camera using the Sony Exmor 1” CMOS sensor, with a focal length of 8.8 mm and the number of effective pixels of 20 megapixels. Still photos were captured in a JPG format. One video was taken in MP4 format, with 4K resolution at 24 frames per second.

¹ RPIC – Remote Pilot In Command

Ground control points were documented with a Trimble GEO7X differential GPS receiver.

Procedures

The accident site was located approximately 0.5 nm from the departure end of runway 13 at Sheboygan County Memorial airport (KSBM). KSBM is a non-towered airport and the common traffic advisory frequency (CTAF) was monitored by the RPIC for any traffic information. The accident site was below the surrounding class E airspace (Class E airspace floor was at 700 ft AGL). The airport manager was notified prior to and after the completion of the flights. Flights were conducted under the provisions of 14 CFR Part 107.

Weather conditions were clear with less than 20 knot winds. The purpose of the UAS imagery was to document the wreckage site and collect still images around the impact area. The sUAS flights were conducted during wreckage clearing operations, so the wreckage or vehicles and trailers are not in the original post-crash positions.

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 an altitude of 125 ft above ground level (AGL) providing an approximate ground sample distance of 0.44 in/pixel. Additional panoramic photos were taken to create images above the initial impact marks, visible in the adjacent corn field, to provide situational awareness in the vicinity of the wreckage path. Total flight time was approximately 40 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 0.80 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 Manitowoc, WI (WMTW). Horizontal and vertical positional accuracy (when compared to features outside the 3D point cloud) was calculated at 43.3 inches horizontally and 39.4 inches vertically.

2.0 Imagery products

Approximately 300 high resolution photos and one video were gathered. Select photos and excerpts from the 3D modelling products 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 contains a still image taken from just prior to the aircraft initial impact point in vegetation (corn field) looking towards the aircraft's final resting place. The aircraft and building wreckage were in the process of being moved during the imagery gathering.

Figure 2 contains a still image taken from just aft of to the aircraft initial impact point in the vegetation (corn field) looking back towards departure airport. An approximate representation of the departing runway is overlaid on the image.

Figure 3 contains an overhead image of initial ground scars at the first visible points of the aircraft impacting the ground. The lines are labelled A, B, C and D from the left to the right of the image. Utilizing the 3D point cloud data created from the aerial imagery, perpendicular distance between the lines were measured. Table 1 contains the measured distances between the ground scars.

Table 1 - Distances between ground scars

Line IDs	Distance (m)	Distance (ft)
A-B	1.72	5.64
B-C	2.73	8.96
C-D	3.37	11.06
A-D	7.82	25.66

Figure 4 and Figure 5 are images taken with the sUAS placed above the initial indications of the aircraft impacting the vegetation (corn field). The view in each image is towards the departure runway. Figure 4 was taken at an altitude of approximately 20 ft above ground level (AGL). Figure 5 was taken at an altitude of approximately 86 ft above ground level (AGL)

Figure 6 and Figure 7 contain screenshots of the orthomosaic map in Google Earth .kmz format. Figure 6 shows the overall accident site with showing initial impact points with the vegetation. Figure 7 is zoomed out to show the general area around the accident site and the proximity to the departing runway.

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 – Original Photograph used in Figure 4

Attachment 5 – Original Photograph used in Figure 5

Attachment 6 – Orthomosaic map in Google Earth .kmz format (ref. Figure 6 and Figure 7)

4.0 Oversized Imagery

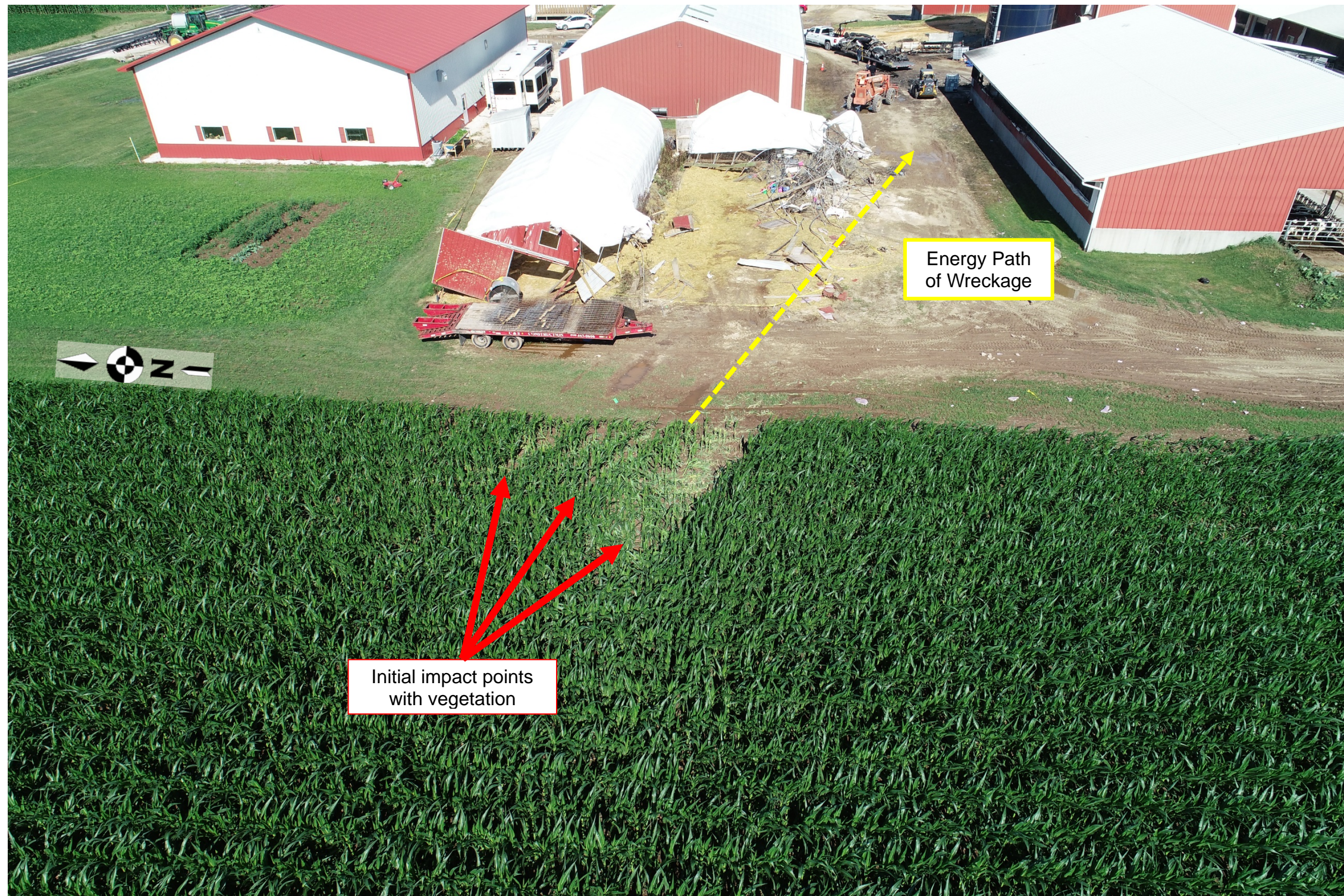


Figure 1 – Photo – Aerial view of main wreckage area, initial impact points, and energy path towards top of page (directional arrow approximated)

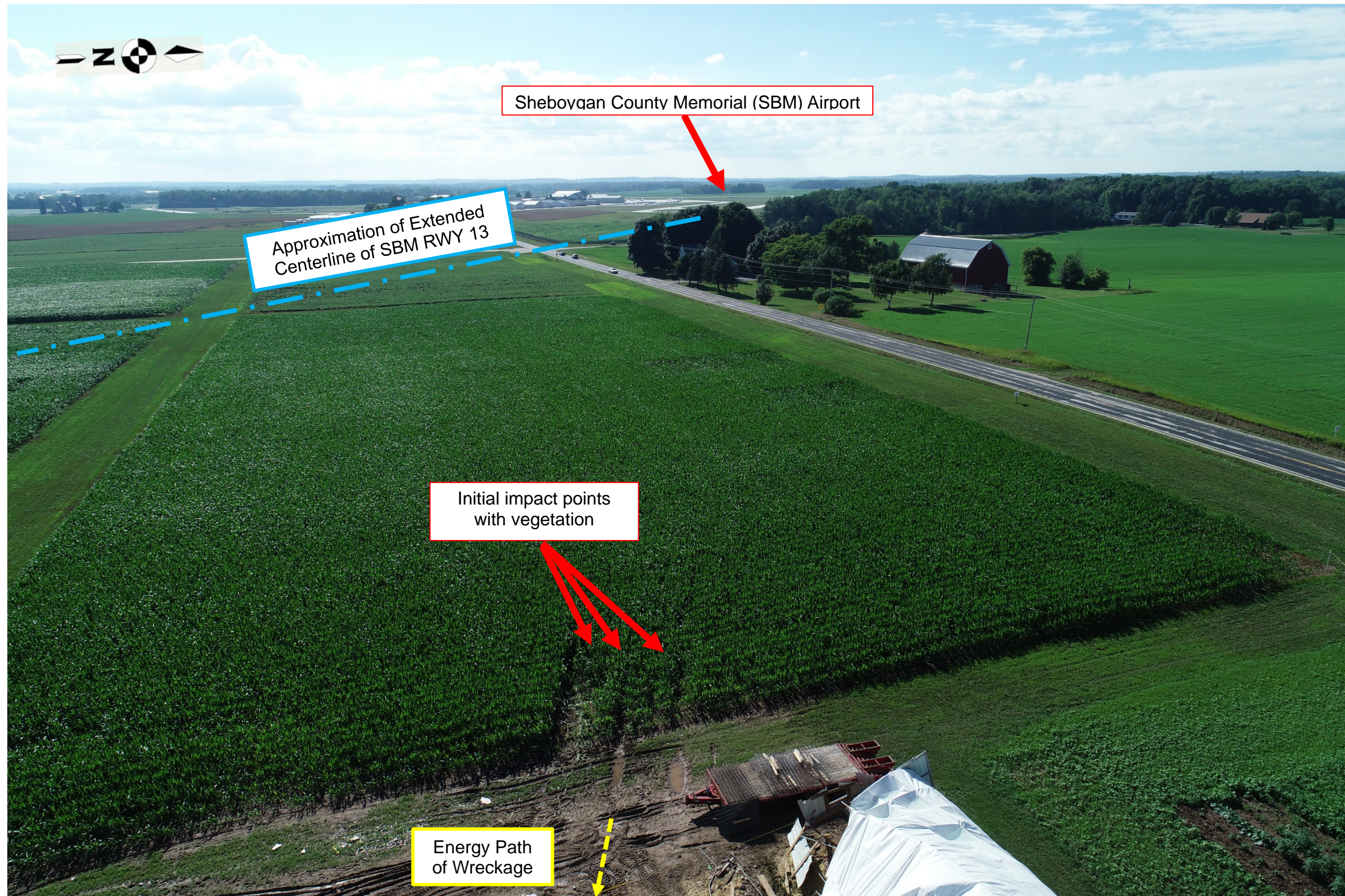


Figure 2 – Photo - Aerial view of initial impact points and energy path towards bottom of page (directional arrow approximated)

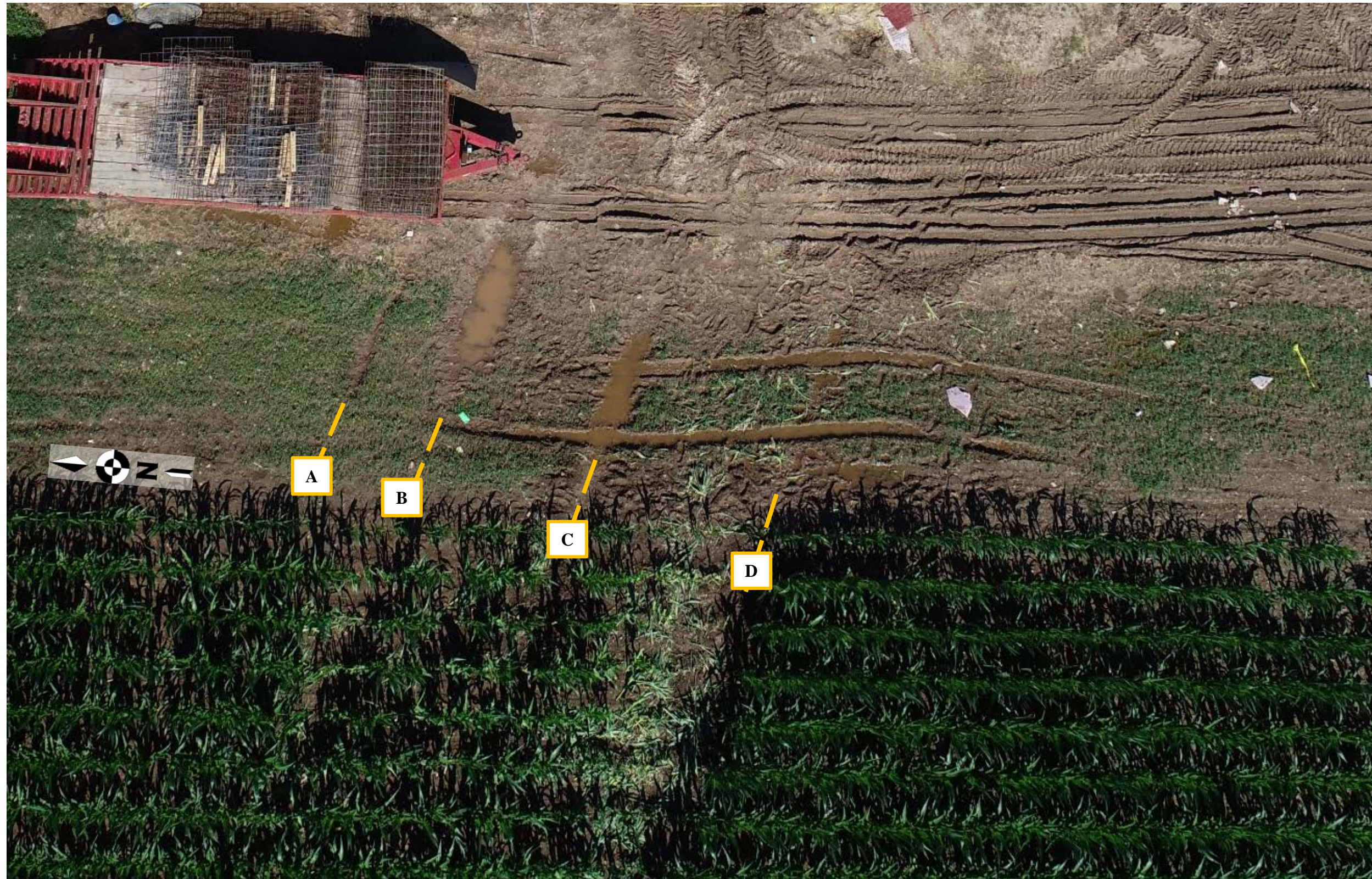


Figure 3 – Photo (Cropped) - Aerial view of vegetation impact marks with three distinct lines identified A, B, C and D for measurement purposes (directional arrow approximated)



Figure 4 – Photo - Aerial view taken from approximately 20 ft about initial vegetation impact points looking towards SBM (directional arrow approximated)

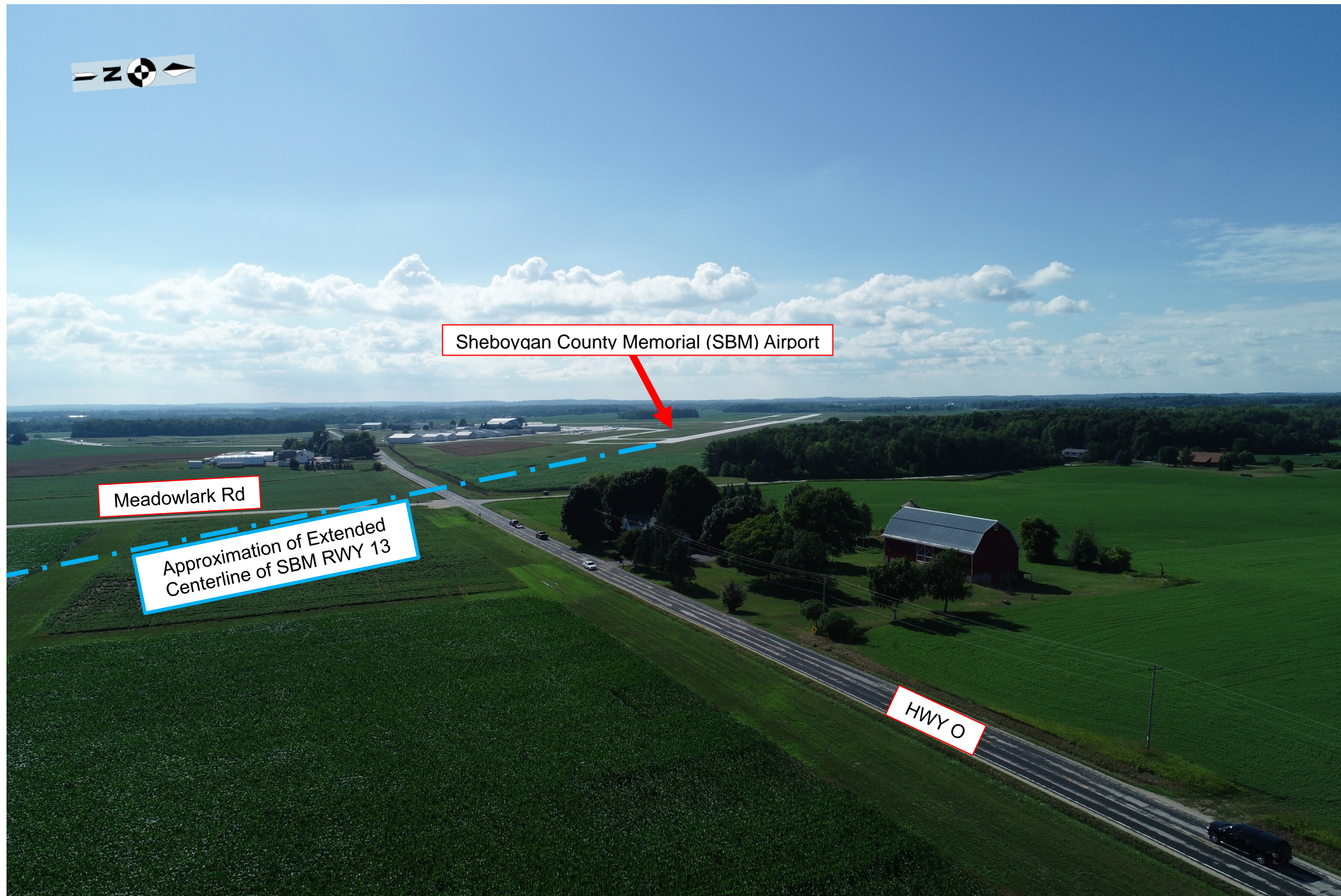


Figure 5 – Photo - Aerial view taken from approximately 86 ft above the initial vegetation impact points looking towards SBM (directional arrow approximated)



Figure 6 – Orthomosaic of accident site overlaid on Google Earth zoomed in to show main wreckage area.

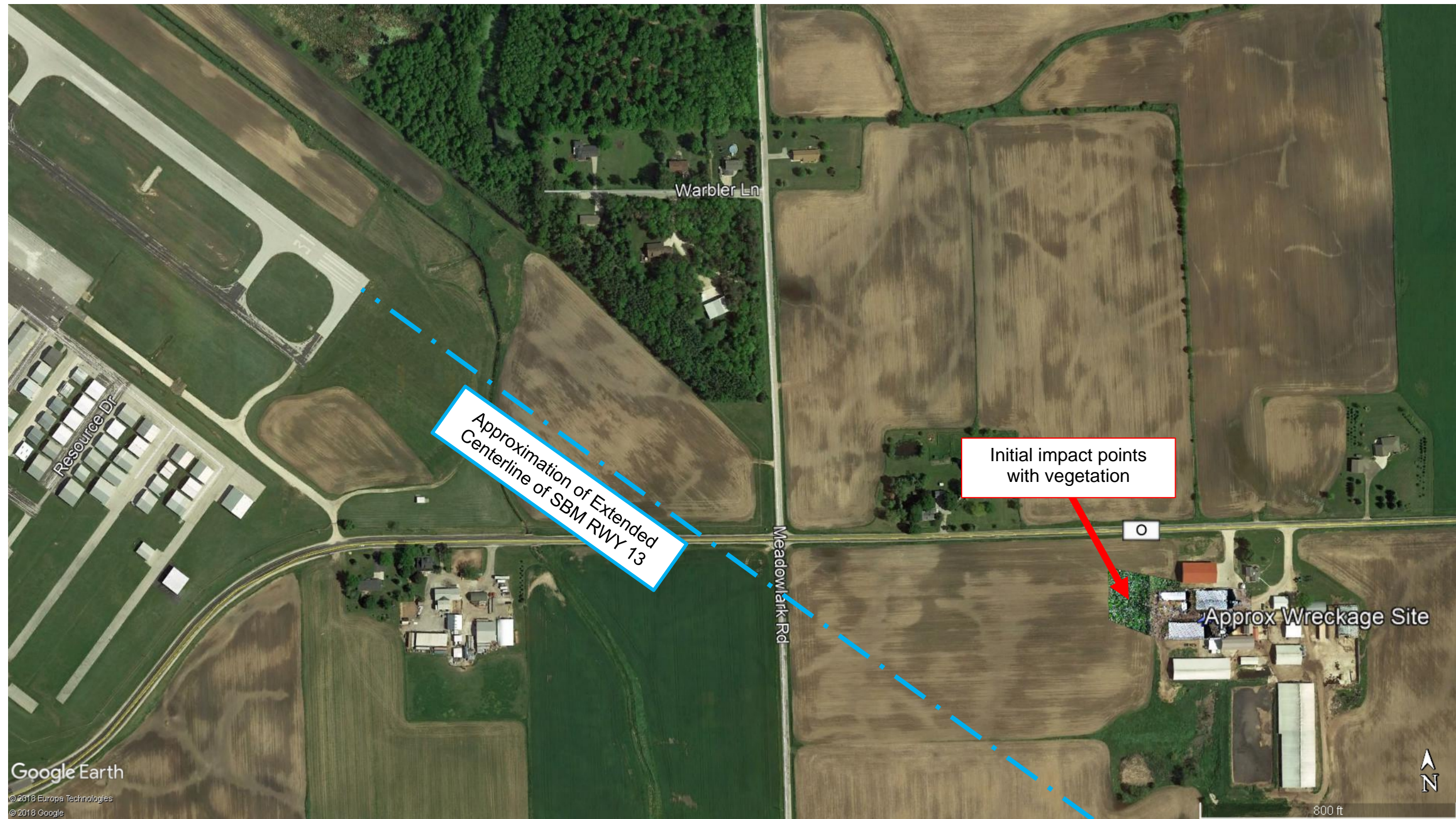


Figure 7 - Orthomosaic of accident site overlaid on Google Earth zoomed out to show SBM RWY 13 and the main wreckage area.