

NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety

Washington, D.C. 20594

Aerial Imagery Factual Report

Hangar, Parking Area and Surrounding Terrain Mapping

11/21/2017

A. ACCIDENT

DCA17FA076

Operator: Ameristar Air Cargo, Inc. dba Ameristar Charters
Location: Willow Run Airport, Ypsilanti, Michigan
Date: March 8, 2017
Time: about 1452 EST
Aircraft: Boeing MD-83
Registration: N786TW

B. PERSONNEL

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

Visual Observer: Mike Bauer
National Transportation Safety Board
Washington, D.C.

C. SUMMARY

On March 8, 2017, about 1452 EST, Ameristar Air Cargo, Inc. dba Ameristar Charters flight 9363, a Boeing MD-83, N786TW, ran off the end of runway 23L after executing a rejected takeoff at Willow Run Airport (YIP), Ypsilanti, Michigan. (The MD-83 was manufactured by McDonnell Douglas, which merged with Boeing in August 1997.) All 110 passengers and 6 crewmembers evacuated the airplane. One passenger was reported to have received a minor injury. The airplane sustained substantial damage (no post-crash fire occurred). The airplane was operating under the provisions of 14 Code of Federal Regulations (CFR) Part 121 as an on-demand charter flight and was destined for Washington Dulles International Airport (IAD), Dulles, Virginia. Daytime visual meteorological conditions prevailed at the time of the accident.

The meteorology group, in conjunction with a request from the systems group, commissioned a wind study of the area around the approximate location where the aircraft was parked the day of the accident. The study utilized a computational fluid dynamics (CFD) model, which required a model of the local topography. The NTSB small unmanned aircraft system was utilized to conduct a mapping mission to generate a 3-dimensional (3D) model of the aircraft hangar and surrounding terrain in an area specified by the meteorology group, see Figure 1. Further details of the wind study can be found in Meteorology Group Chairman's Factual Report.



Figure 1 - Area (denoted by yellow outline) of planned mapping flights at YIP (north up)

D. DETAILS OF IMAGERY

1.0 Equipment and Procedures

Equipment

Mapping flights were conducted on May 24, 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.

Procedures

YIP airport has an associated Class D airspace. The NTSB obtained an amended Certificate of Authorization or Waiver (eCOA) from the FAA to operate “At or Below: 150-250 feet Above Ground Level, as coordinated with ATCT YIP”. In accordance with the eCOA, a Notice to Airmen (NOTAM) was issued and continuous communications with the ATCT were maintained. Airport operations were not affected during the sUAS missions.

The drone was flown in a series of seven missions with overlapping grids and oblique orbits between 100 and 150 feet above ground level (AGL) obtaining still photos to develop a 3D model and an orthomosaic. The coverage area extended from the Northern end of Hangar 1 and extended to include a small hangar and portions of Willow Run between Tyler Road and Airport Drive. A total of seven missions were flown for a total flight time that was less than 1 and 1/2 hours.

Ground Control Points

Multiple ground control points (GCPs) were selected in the areas being photographed. The position of each GCP was logged using a Trimble Geo7X handheld Global Navigation Satellite System (GNSS). During the position logging, the position is sampled multiple times for use in the correction algorithms. The logged positions of each GCP were then postprocessed using the Trimble GPS Pathfinder Office software and a nearby Continuously Operating Reference Station (CORS) to increase the positional accuracy of the handheld measurements. The CORS station used for the corrections was Willow Run (WRUN) located in Willow Run, MI and operated by the Michigan Department of Transportation. Positional (absolute) accuracy, was approximately 15.75 inches (0.4 m).¹

Processing

Still imagery and GCP information was processed using Pix4D photogrammetry software to provide a 3-d point cloud and an orthomosaic map of the entire site. Relative accuracy, within the map, was approximately 0.96 inch.²

¹ Positional accuracy was computed by taking the largest value of horizontal or vertical precision from the corrected GCP points and multiplying the value by 2.0.

² Relative accuracy was computed by taking the average value of ground sample distance and multiplying the value by 2.0.

2.0 Imagery products

Approximately 900 high resolution photos were gathered. Select still images and samples of processed products are included in this section and in the docket for this accident.

A full-resolution orthomosaic .kmz file³ was developed and is included as Attachment 1. Figure 2 shows the orthomosaic overlaid on Google Earth.

Figure 3 shows the output of the 3D model. Figure 4 shows as side by side comparison of a drone image and the 3D model output. Figure 5 and Figure 6 are selected snapshots from the 3D model.

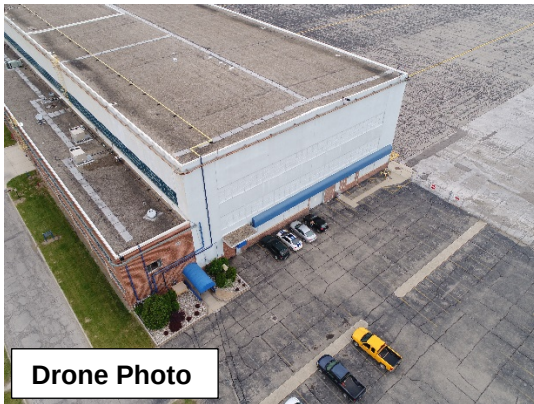


Figure 2 - Snapshot of orthomosaic with planned mapping area outlined in yellow.

³ A .kmz file is a compressed (zipped) file that contains imagery and corresponding keyhole markup language (KML) files in order to view the imagery and associated file information on Google Earth. Pix4D generates a collection of KML files based on the collected drone imagery.



Figure 3 - Snapshot of mapped area 3D model



Drone Photo



3D Model

Figure 4 - Side by side view of drone photograph and 3D model of Hangar 1



Figure 5 – Snapshot of southeastern corner Hangar 1 at YIP, 3D Model



Figure 6 - View of southwestern corner of Hangar 1 at YIP, 3D Model

The 3D model was output to a .obj file format⁴ for use by the Meteorology group for the wind study.

3.0 Attachments

Attachment 1 – Hangar 1 and surrounding terrain Google Earth .kmz export

⁴ A .obj file is a geometry definition file. The format is an open format and was developed by Wavefront Technologies for its animation software. The format is also used by various other 3D graphic applications.