NATIONAL TRANSPORTATION SAFETY BOARD
Vehicle Recorder Division
Washington, D.C. 20594

April 1, 2015

Electronic Devices

Specialist's Factual Report
by Bill Tuccio, Ph.D.

1. EVENT

Location:	Westminster, Maryland
Date:	December 27, 2014
Aircraft:	Piper PA-28-140
Registration:	N95297
Operator:	Private
NTSB Number:	ERA15LA084B

On December 27, 2014, about 1545 eastern standard time (EST), a Piper PA-28-140, N95297, and a Pitts Special S-1S, N49294, were substantially damaged when they collided while on final approach into Carroll County Regional Airport (DMW), Westminster, Maryland. The private pilot and passenger of the Piper were not injured. The private pilot of the Pitts received serious injuries. Visual meteorological conditions prevailed and no flight plan was filed for either flight. The Piper departed Lancaster Airport (LNS), Lancaster, Pennsylvania on a local flight at 1500 and the Pitts departed DMW on a local flight at 1545. Both personal flights were conducted under the provisions of Title 14 *Code of Federal Regulations* Part 91.

2. DETAILS OF DEVICE INVESTIGATION

The National Transportation Safety Board (NTSB) Vehicle Recorder Division received the following devices from aircraft N95297:

Device 1:	Apple iPad 2
Device 1 Serial Number:	DMPH22VRDFJ2
Device 2:	Adventure Pilot iFly 700a
Device 2 Serial Number:	MB170125

2.1. Apple iPad Device Description

The Apple iPad is a tablet computer with a high-resolution color touch-screen interface. All iPad devices support WiFi and Bluetooth connectivity, and use either 16, 32, or 64 GB of non-volatile memory[1] for storage (depending on model). Some devices also

[1] Non-volatile memory is semiconductor memory that does not require external power for data retention.

support data connectivity via existing cell-phone networks. The iPad also includes front and back cameras. The iPad implements its functionality by running programs called "Apps" capable of supporting web-browsing, email, audio/video playback, contact and calendar management, and numerous other specialized functions. User-installed Apps can be used to support functionality for electronic flight bags, flight planning and filing, aviation weather depiction, and electronic flight charts. Application data is stored in non-volatile memory and may include image, video, and position location information. Specialized application data may be stored in a proprietary file structure using numerous proprietary file formats. The amount and type of data stored varies based on the software version and configuration of the specific device.

2.1.1. Apple iPad 2 Data Recovery

Upon arrival at the Vehicle Recorder Laboratory, an exterior examination revealed the device had not sustained any damage. Power was applied to the device, screens were photo documented, and a forensic download was performed.

2.1.2. Apple iPad 2 Data Description

Information pertinent to the investigation was contained in the ForeFlight application. The screen photos shown in figures 1 and 2 contain a message indicating the map was expired; however, the photos were taken on January 9, 2015, after an aeronautical charting period began that was different from that of the accident flight. At the time of the iPad review, ForeFlight version 6.6 (1425) was installed.

Figure 1 shows the ForeFlight map screen that was displayed upon opening the ForeFlight application. Figure 2 shows the ForeFlight map screen zoomed out to show the entire navigation route from LNS to DMW. Figure 3 shows the navigational route consisting of "KLNS" to "45º to 16" to "KDMW."

The map showed a direct route from LNS to a left downwind entry for runway 16 at DMW. The approximate 43 nautical mile (nm) leg from LNS to the left downwind entry for runway 16 was depicted in magenta; the remainder of the route (the 45º left downwind traffic pattern entry and traffic pattern) were shown in blue. According to the *Pilot's Guide to ForeFlight Mobile* (33rd Edition), "The route line drawn on the map is color-coded to indicate the active leg. Magenta is the current leg, blue is a future leg, and orange is a past leg."

Version 6.6 of ForeFlight is capable of recording track history if selected by the pilot. Only one prior tracklog was recorded in November, 2014, before the accident flight.

Figure 1. ForeFlight map screen displayed upon opening ForeFlight.

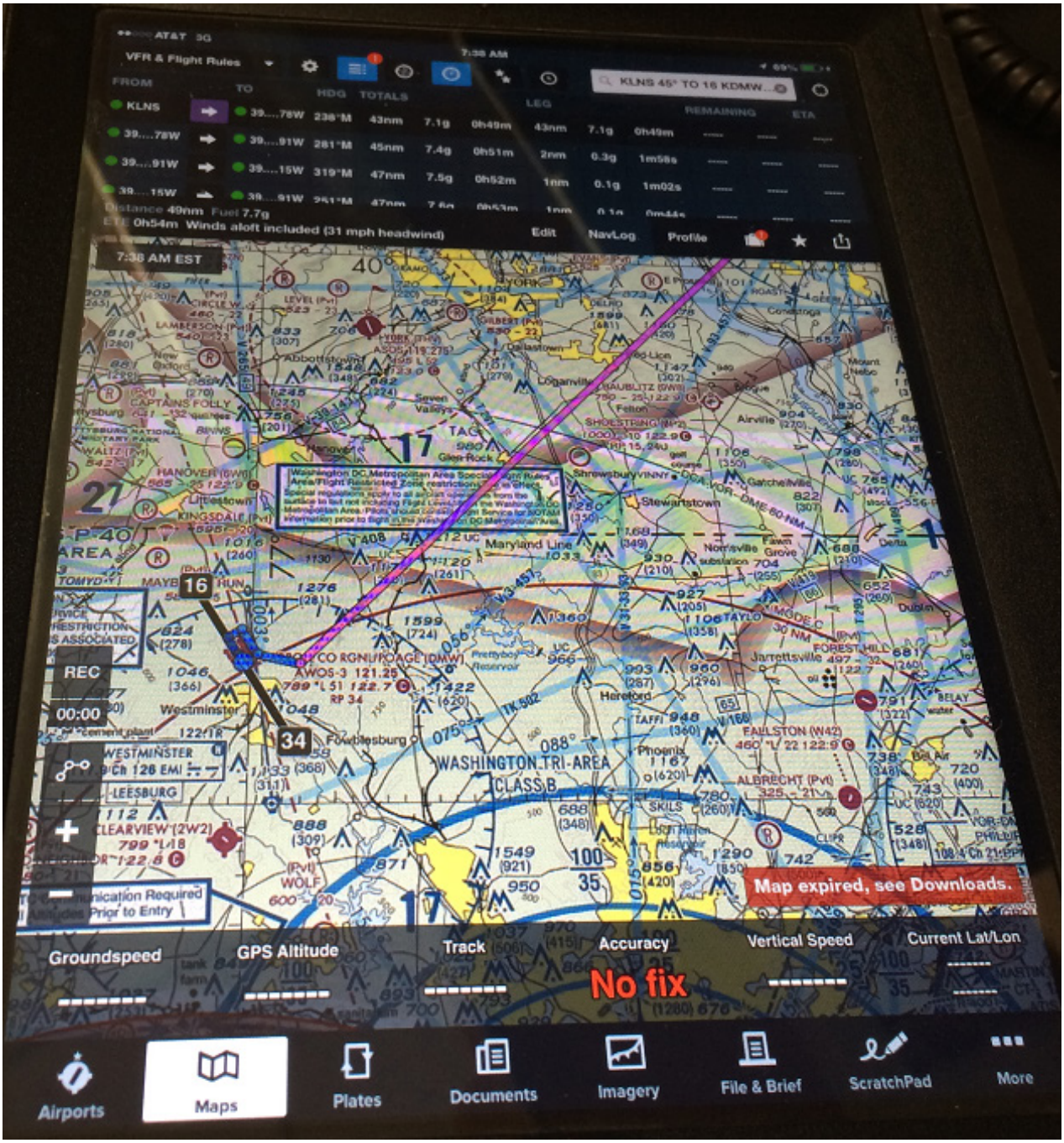


Figure 2. ForeFlight map zoomed out to show entire navigation route.

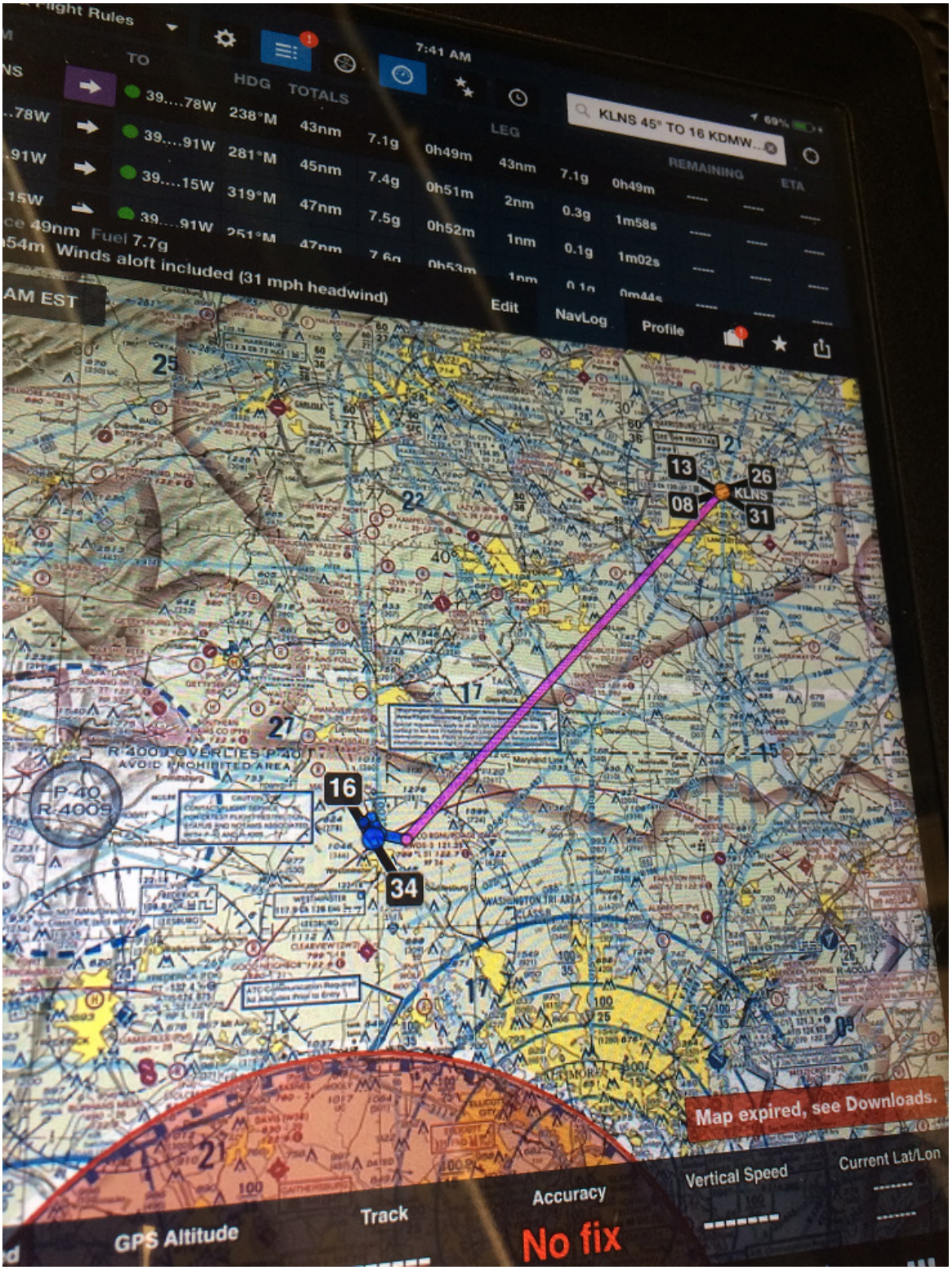
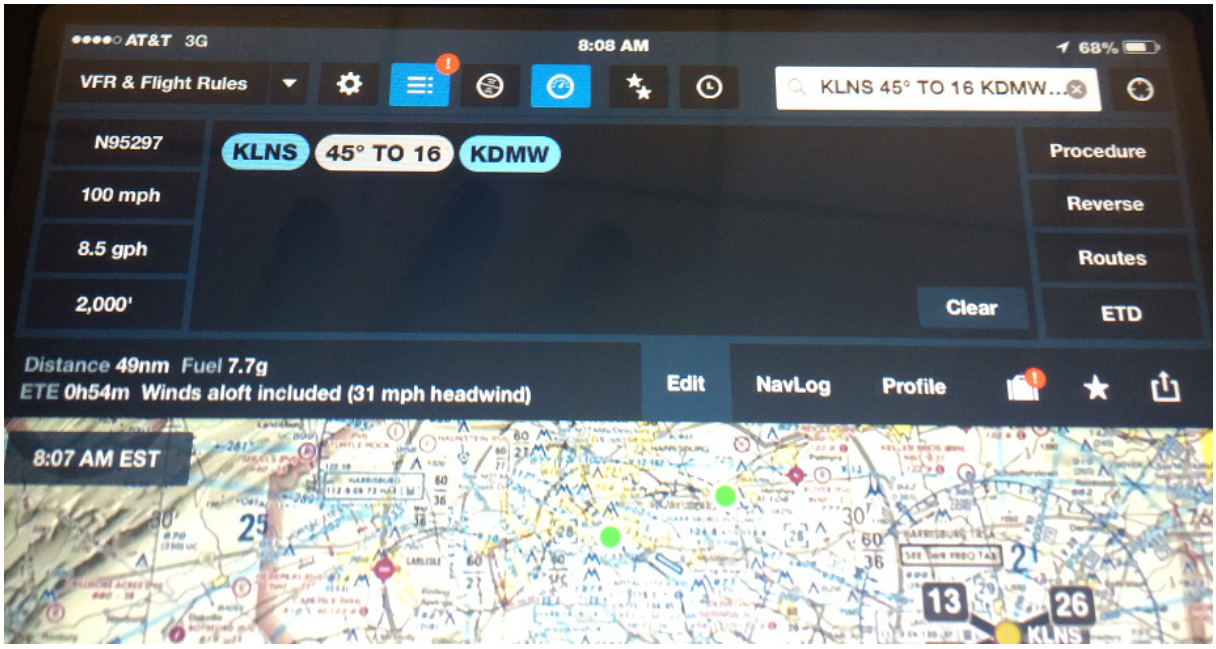


Figure 3. ForeFlight navigational route edit view.



2.2. Adventure Pilot iFly 700a Device Description

The Adventure Pilot iFly 700a is an externally-powered, multi-function display and GPS receiver with a high resolution, LCD touch screen display. The unit includes a built-in navigational database and is optionally capable of receiving inflight ADS-B information including NEXRAD weather radar, airport weather reports (METARs), weather forecasts, and traffic advisories. The navigational and information features include terrain warnings, airspace alerts, and display of enroute VFR and IFR navigational information and IFR approach charts.

The unit is capable of recording track history to a removable SD card that is compatible with a Microsoft file allocation table (FAT) file system. Track history data are written as National Marine Electronics Association (NMEA) 0183 compatible sentences containing local time (as selected by the user), latitude, longitude, and altitude.

2.2.1. Adventure Pilot iFly 700a Data Recovery

The device was in good condition and the data were extracted from the SD card normally. The NMEA 0183 track history sentences were converted to comma delimited value (CSV) and Keyhole Markup Language (KML) formats using GPSBabel software.

2.2.2. Adventure Pilot iFly 700a Data Description

Log files existed for multiple flights, including the accident flight. The log files were recorded in EST. The accident flight recording consisted of 502 data points on December 27, 2014 from 14:58:08 EST to 15:44:08 EST.

2.2.3. Adventure Pilot iFly 700a Parameters Provided

Table 1 describes data parameters provided by the GPS device. Date, Time, Latitude, Longitude, and GPS Altitude are recorded by the device.

Table 1: GPS Data Parameters

Parameter Name	Parameter Description
Date	Date for recorded data point (MM/DD/YYYY)
Time	Time (EDT) for recorded data point (HH:MM:SS)
Latitude	Recorded Latitude (degrees)
Longitude	Recorded Longitude (degrees)
GPS Alt	Recorded GPS Altitude (feet (ft)), MSL)

Note: MSL means altitude above mean sea level

2.2.4. Adventure Pilot iFly 700a Overlays and Tabular Data

Figures 4 through 7 contain track log overlays produced in Google Earth of aircraft N95297. Weather and lighting conditions depicted in Google Earth are not necessarily representative of conditions at the time of the accident.

Figure 4 shows an overview of the accident flight recording overlayed on an aviation sectional chart. The recording began at LNS. After departure, the aircraft flew southwest towards DMW and entered left traffic for runway 16.

Figure 5 shows the ground operations at LNS. The recording began at 14:58:08 EST. By 15:03:15 EST, the aircraft had taxied to the departure end of runway 31. By 15:08:55 EST, the aircraft began the takeoff on runway 31.

Figure 6 shows the arrival into DMW. At about 15:34 EST, the aircraft turned towards the south and began to descend out of about 3,000 ft. At about 15:37 EST, the aircraft turned back towards the west and continued to descend out of about 1,800 ft. At about 15:40 EST, the aircraft turned right at about 1,600 ft, consistent with a left downwind for runway 16 at DMW. At 15:41:41 EST, the aircraft descended through 1,473 ft as it turned left, consistent with a left base for runway 16. At 15:43:01 EST, the aircraft descended through 1,237 ft and turned left, consistent with a final approach for runway 16.

Figure 7 shows the end of the accident flight recording. The recording ended at 15:44:08 EST, about 1,600 ft northwest of the runway 16 landing threshold, at a recorded altitude of 919 ft.

Tabular data used to generate figures 4 through 7 are included as attachment 1 in electronic comma-delimited (.CSV) format.

Figure 4. iFly 700a accident flight recording overview.

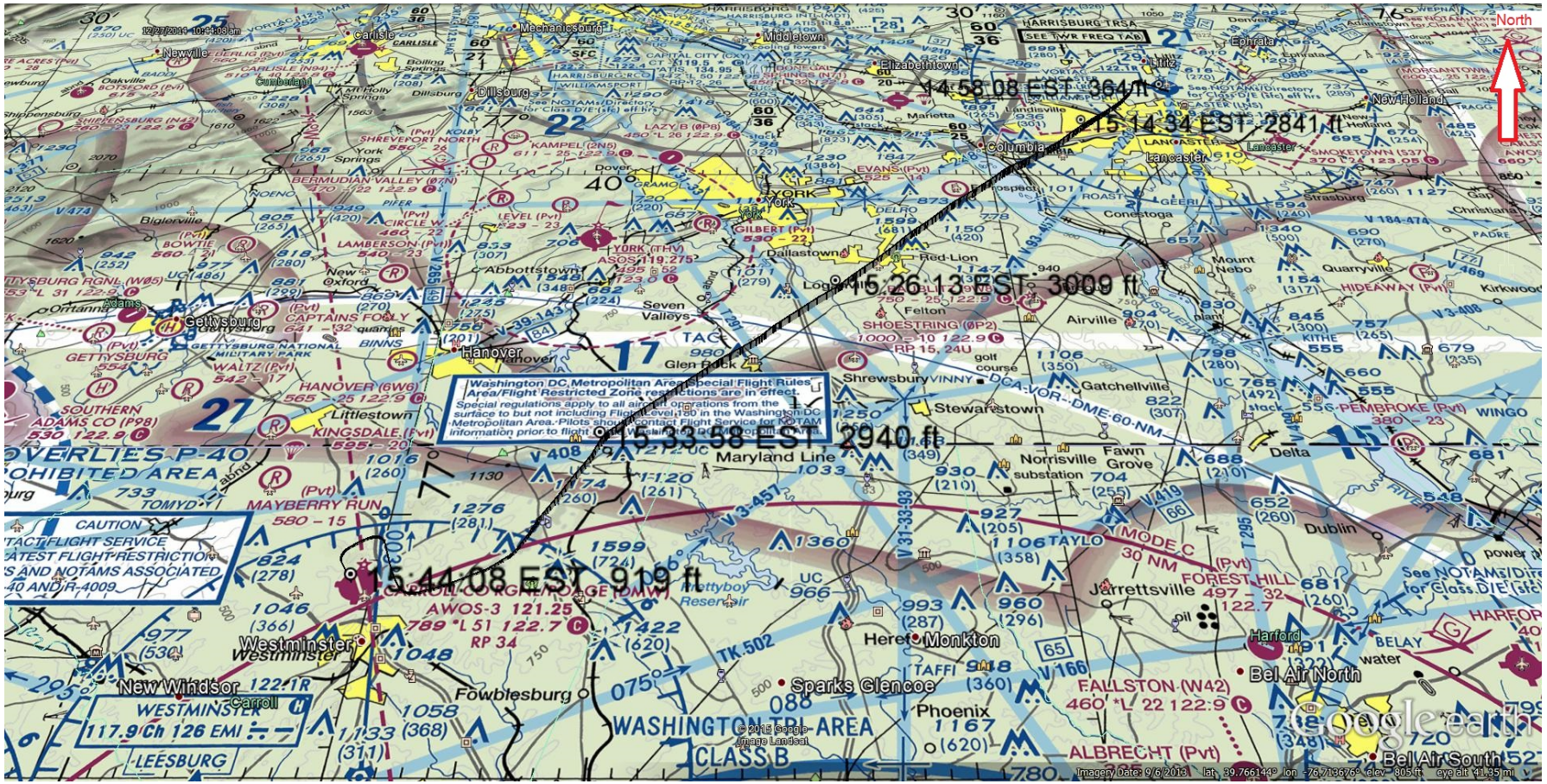


Figure 5. iFly 700a start of accident flight recording, ground operations at LNS.

Figure 6. iFly 700a arrival into DMW.

Figure 7. iFly 700a end of accident flight recording.