

NATIONAL TRANSPORTATION SAFETY BOARD

Vehicle Recorder Division
Washington, D.C. 20594

May 10, 2019

Non-Volatile Memory Devices

Specialist's Factual Report Marie Moler

1. Event

Location: Arlington, Indiana
Date: July 6, 2018
Aircraft/ID: Bell 47G / N96195
Operator: Private
NTSB Number: CEN18FA258

2. Event Summary

On July 6, 2018, about 1720 eastern daylight time, a Bell 47G-2 helicopter, N96195, was substantially damaged when it impacted a corn field near Arlington, Indiana. A post impact fire ensued. The commercial pilot was fatally injured. The aerial application flight was conducted under the provisions of 14 *Code of Federal Regulations* Part 137. Visual meteorological conditions prevailed and no Federal Aviation Administration (FAA) flight plan had been filed for the flight. The local flight departed a loading platform at a farm 1 mile northwest of the accident location at about 1655.

3. Details of Device Investigation

The NTSB Vehicle Recorder Division received the following devices:

Device 1: Trimble Trim Flight 3
Device 1 Serial Number: 4618B07595
Device 2: Lowrance AIRMAP 2000C
Device 2 Serial Number: 101979244

The Trimble Trim Flight 3 and Lowrance AIRMAP 2000c were received exhibiting moderate damage consistent with impact, as seen in Figure 1 and Figure 2. The SD cards¹ were removed from the devices and read using NTSB laboratory equipment.

¹ A secure digital (SD) card is non-volatile memory card format developed by the SD Card Association (SDA) for use in portable devices. Non-volatile memory is semiconductor memory that does not require external power for data retention.

3.1. Trimble Trim Flight 3 Device Description

The Trimble TrimFlight 3 is a GPS device for use in agricultural application. The device is designed to be mounted in the aircraft's cockpit and has a small electronic display. The device works in conjunction with Trimble's AgGPS 132 FlightBar which provides visual guidance to the pilot during agricultural application. The device has the capability to store agricultural guidance routines, field boundaries, mapped features as well as store user tracklogs. The system records flight data directly onto a CompactFlash (CF) data card using the ESRI shapefile format. The data is designed to be read in Geographic Information System (GIS) software that allows the user to generate custom plots and reports. The ESRI data was read using the ArcGIS program.

3.1.1. Trimble Trim Flight 3 Data Description

The data extracted from the Trimble included five flights from July 6, 2018, but at a separate location, about 20 miles south of the accident (Figure 3) near Milford, Indiana. The flight lengths were 15 minutes, 47 minutes, 12 minutes, one hour 17 minutes, and one hour two minutes. Also extracted was a single 48-minute flight from July 4th, 2018, near Canoochee, Georgia (Figure 4).

3.2. Lowrance AIRMAP 2000c Device Description

The Lowrance AIRMAP 2000c is a WAAS-capable, battery operated hand-portable 12-channel mapping GPS unit equipped with a 320 x 240 pixel color LCD display, soft key controls, and support for custom maps. It contains a slot for a multi-media card (MMC) or Secure Digital (SD) FLASH memory card. This card may be used to transfer and store custom map, waypoint, route, and trail data between a desktop PC and the GPS unit. A serial interface using NMEA 0183 communication protocols is mounted in the back of the GPS unit, but the internal operating software does not support the download of saved data via this serial port. The Lowrance AIRMAP 2000c can store up to 100 routes composed of up to 100 waypoints each. The unit can also store trail data composed of up to 10,000 latitude-longitude points per trail. Up to 100 individual trails may be named and saved by the user. Once the limit has been reached for recording continuously updated trail data, older latitude/longitude points are overwritten with new data on a first-in, first-out basis. The AIRMAP 2000c may be programmed to update trail data in one of three ways: automatically, by time, or by distance traveled. The default 'automatic' mode only updates trail data when the GPS unit senses that position has changed by at least 0.1 miles, or that direction has changed by 2 degrees or more. Updating by time may be set to record a new point every 1 to 9,999 seconds. Updating by distance may be set to record a new point whenever the distance traveled from the last update exceeds anywhere from 0.01 miles to 9.99 miles. All recorded data is stored internally in non-volatile memory and may be copied to an MMC or SD card inserted in a card slot in the battery compartment. This card may be read using a standard desktop PC running the Microsoft Windows operating system.

3.2.1. Lowrance AIRMAP 2000c Data Description

The Lowrance contained data from three flight tracks, one of which was the accident flight (Figure 5). The data does not contain altitude or time data, so the time lengths of the tracks are not known. The last data point of the final flight is shown in Figure 6 and its location is consistent with the reported wreckage.

4. OVERLAYS AND TABULAR DATA

Figure 3 through Figure 6 are Google Earth overlays of the recorded flights. Tabular data used to generate these figures are included as Attachment 1 for the Trimble Trim Flight 3 data and Attachment 2 for the Lowrance Airmap 2000c data. These attachments are provided in electronic comma-separated value (.CSV) format.



Figure 1: Trimble Trim Flight 3 S/N: 4618B07595.



Figure 2: Lowrance AIRMAP 2000C S/N: 101979244.

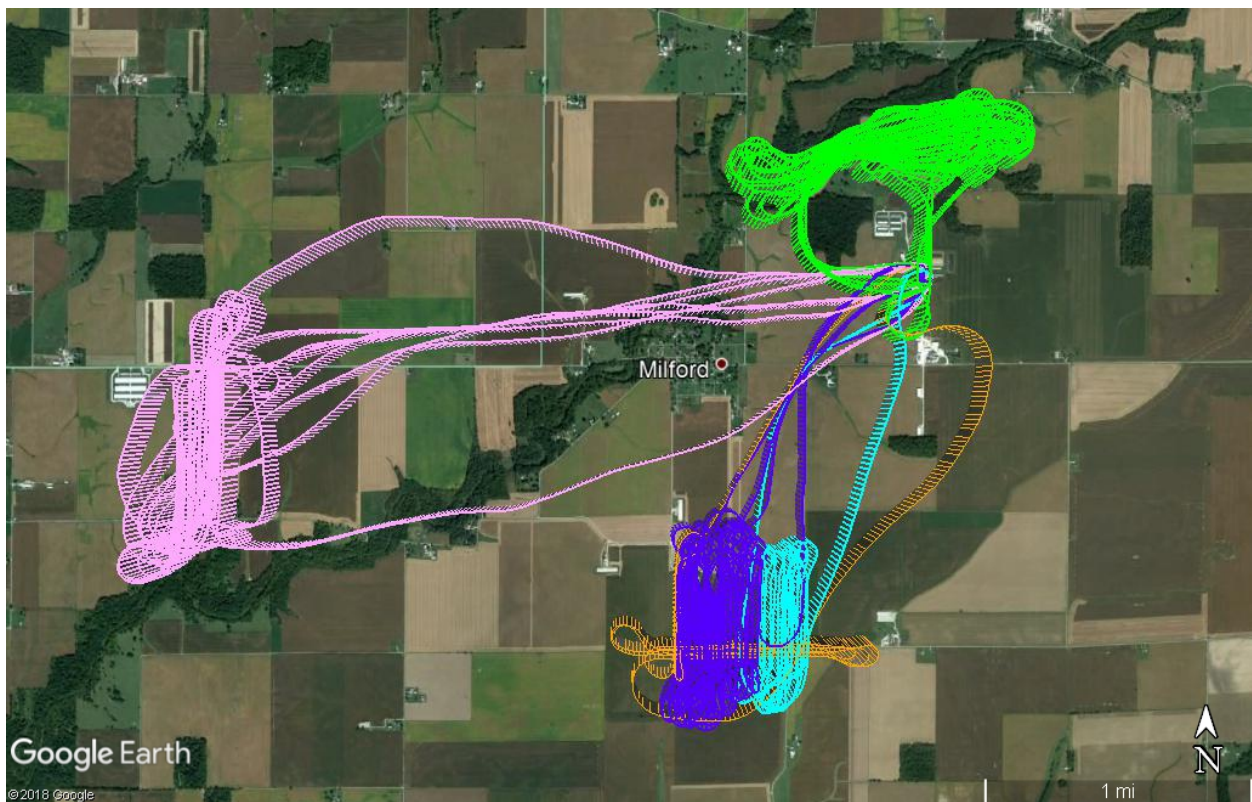


Figure 3: Five flight paths from July 6, 2018 on the Trimble Trim Flight 3.

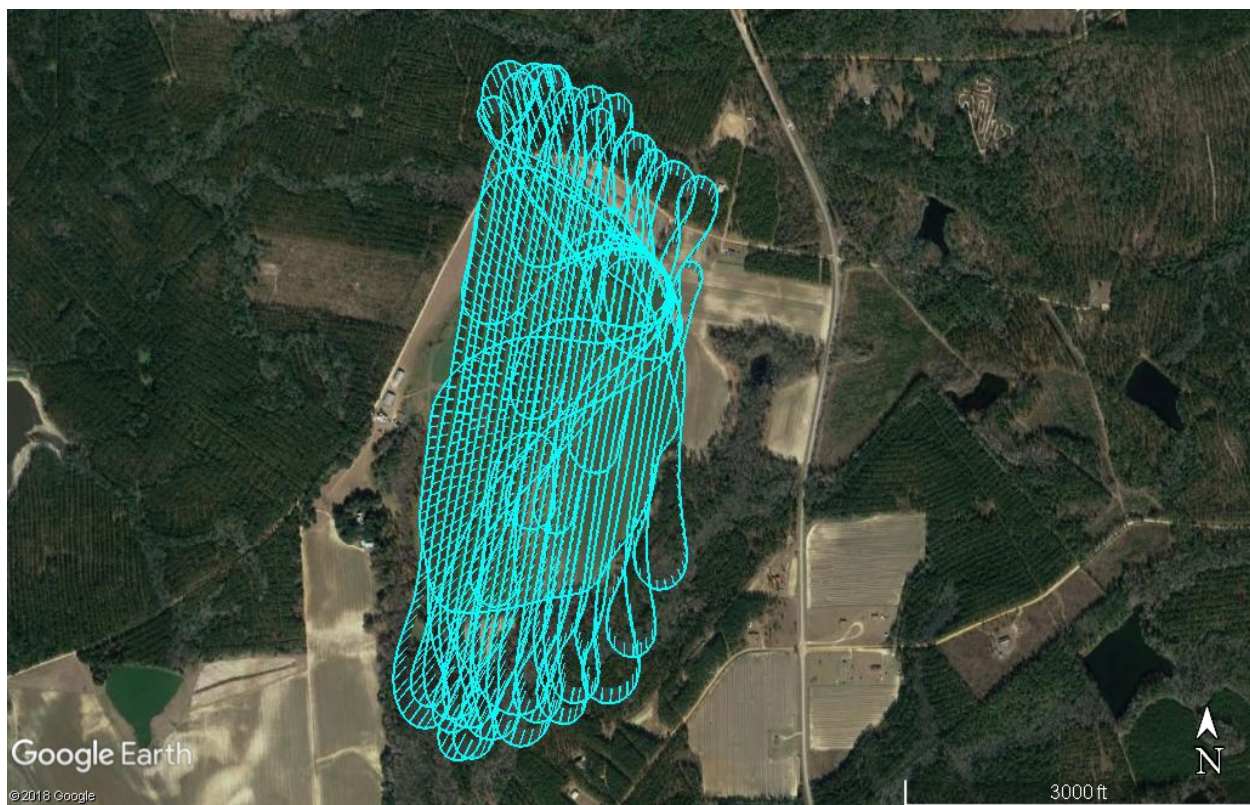


Figure 4: One flight path from July 4, 2018 on the Trimble Trim Flight 3.

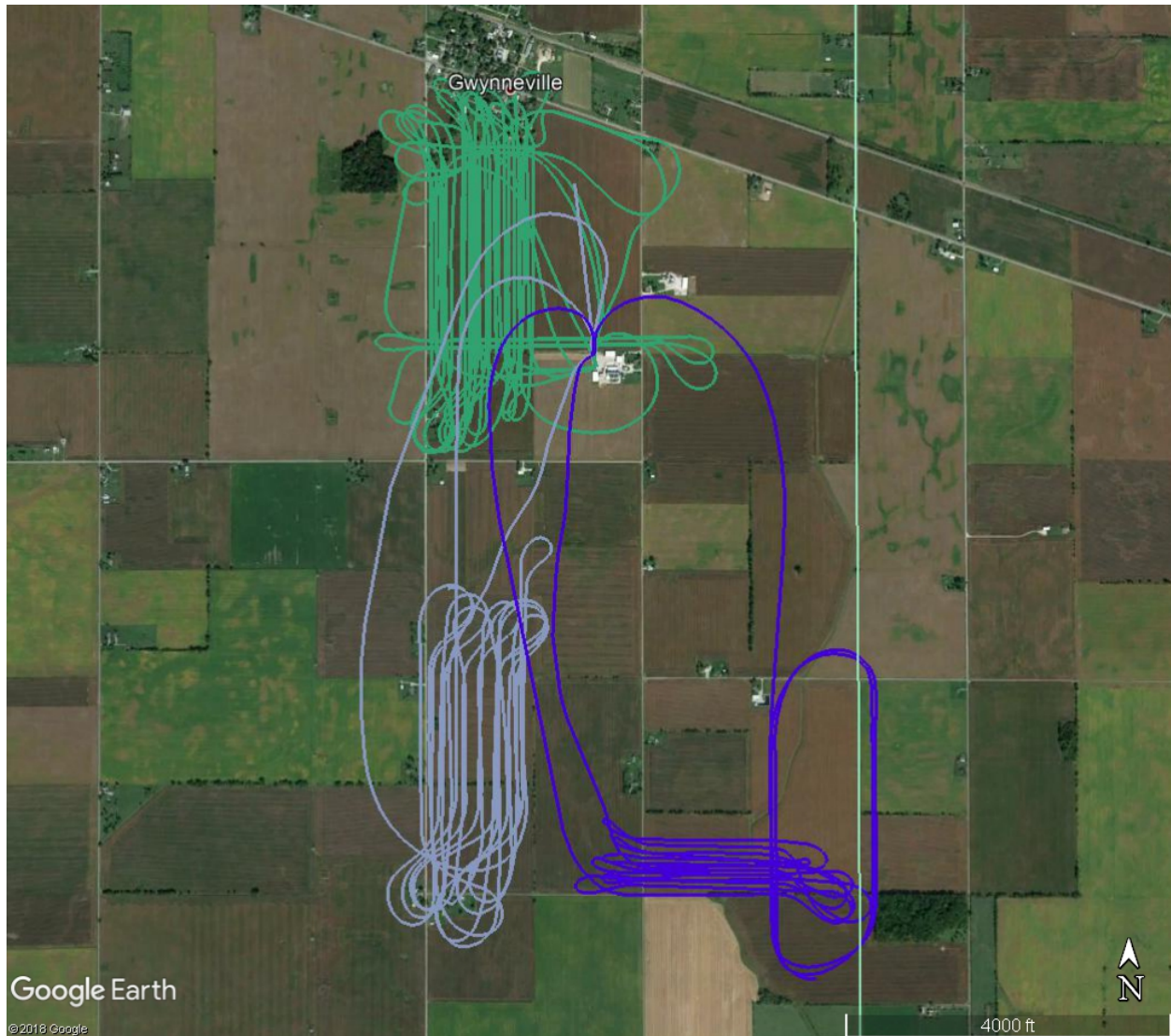


Figure 5: Three flight tracks recorded on Lowrance Airmap 2000c. The dark purple track in the bottom right corner is the accident flight. No times or altitudes are associated with the latitude-longitude tracks.

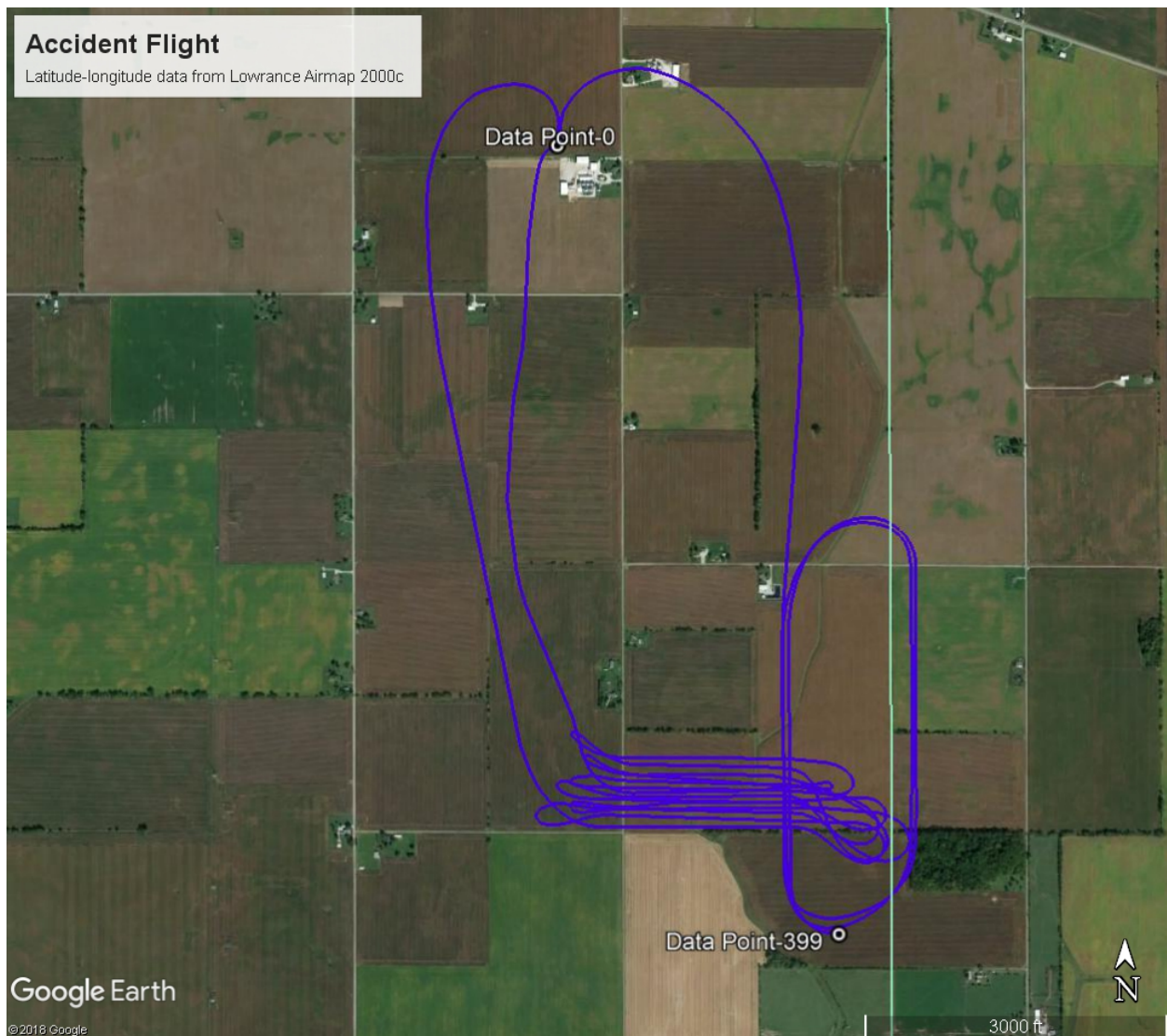


Figure 6: Accident flight from Lowrance Airmap 2000c data. First (Data Point-0) and last (Data Point-399) data points are shown.