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

June 5, 2017

Global Positioning System and Communications Devices

Specialist's Factual Report
by Sean Payne

1. EVENT

Location:	Carrollton, Georgia
Date:	September 7, 2016
Aircraft:	Hawker Beechcraft F33A / Diamond Aircraft Industries DA20-C1
Registration:	N6027K (F33A) / N85WP (DA20-C1)
Operator:	Private
NTSB Number:	ERA16FA312AB

On September 7, 2016, at 1047 eastern daylight time, a Beech F33A, N6027K, and a Diamond Aircraft Industries DA20-C1, N85WP, collided in midair on the final approach leg of the traffic pattern to runway 35 at West Georgia Regional Airport (CTJ), Carrollton, Georgia. The Beech was substantially damaged and the private pilot was fatally injured. The Diamond was destroyed and the flight instructor and one student pilot were fatally injured. The Beech was registered to and operated by the private pilot. The Diamond was registered to and operated by Falcon Aviation Academy LLC. Both flights were conducted under the provisions of 14 *Code of Federal Regulations* Part 91; the Beech pilot was conducting a personal flight to CTJ and the Diamond pilots were conducting a local, instructional flight. Visual meteorological conditions prevailed, and no flight plans were filed for the Beech or the Diamond. The Beech departed from Fulton County Airport (FTY), Atlanta, Georgia about 1020, and the Diamond departed from Newnan Coweta County Airport (CCO), Newnan, Georgia about 1000.

2. DETAILS OF INVESTIGATION

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

Device 1:	Bendix King KX155 COM
Device 1 Serial Number:	55806
Aircraft:	N6027K (F33A)
Device 2:	Garmin GNS-530
Device 2 Serial Number:	78412499
Aircraft:	N6027K (F33A)

Device 3:	Garmin GPSMAP 396
Device 3 Serial Number:	28207136
Aircraft:	N6027K (F33A)

2.1. Bendix King KX155 COM Device Description

The Bendix King KX155 is a navigational and communication transceiver. The device is capable of receiving 200 navigational VHF channels as well as transceiving 760 VHF communications channels. The user can set both an “Active” and “Standby” frequency which allows the user to change switch between the two efficiently. The unit has a built in glideslope receiver. The unit stores) the frequencies entered in both the “Active” and “Standby” frequency banks in non-volatile memory[1] (NVM).

2.1.1. Bendix King KX155 Data Recovery

Upon arrival at the Vehicle Recorder Division, an exterior examination revealed the unit had sustained only light impact damage. However, the unit was unable to be powered in the laboratory. Figure 1 shows the arrival condition of the unit. The unit was sent to the manufacturer for repair under the supervision of a Federal Aviation Administration (FAA) Aviation Safety Inspector from the FAA’s Kansas City, Missouri Flight Standards District (FSDO) Office. The device was powered and the frequencies retained within the unit’s NVM were observed on the unit’s display.

Figure 1. The Bendix King KX155 as received.

2.1.2. Bendix King KX155 COM Data Description

Figure 2 shows the unit after being powered up at the manufacturer’s facility. The “Active” communications frequency was 118.17 MHz and the “Standby” communications frequency was 126.22 MHz. The “Active” navigational frequency was 116.90 MHz and the “Standby” navigational frequency was 109.60 MHz. No other information was obtained from the unit.

[1] Non-volatile memory (NVM) – semi-conductor memory that does not require power to retain data.

Figure 2. The device displaying the retained communications and navigational frequencies.

2.2. Garmin GNS-530 Device Description

The Garmin Model GNS 530 is a panel-mounted GPS receiver featuring a 5-inch color liquid crystal (LCD) display and offering navigation and communication data, along with precision and non-precision approach certification in the IFR environment. The unit has a slot for a Jeppesen database (front-loading data card) containing all airports, VORs, NDBs, intersections, Approach, STAR/SIDs and SUA information. A flight plan composed of multiple waypoints, including user-defined waypoints, can be programmed in the unit. However, no provision has been made to record and store position information within the unit. Data related to last known frequency settings and last known GPS location is stored in NVM and may be read from the front panel display upon power-up. There are no provisions for downloading stored data to a PC. An internal button-battery is used to back-up power to the internal memory and real-time clock during those periods when main power is removed.

2.2.1. Garmin GNS-530 Data Recovery

Upon arrival at the Vehicle Recorder Laboratory, an exterior examination revealed the unit had sustained some impact damage. The screen was determined to be non-functional. The screen was replaced and the unit was able to function normally. The unit was powered and the display pages were explored. Figure 3 shows the device while being powered.

Figure 3. The Garmin GNS-530W after being repaired.

2.2.2. Garmin GNS-530 Data Description

Upon power up, the device showed that the installed “Aviation Database” expired on November 12, 2015. The unit displayed the “Basemap Land Database” was version 2.00, the “Terrain Database” was version 2.04 and the “Airport Terrain Database was version 2.02. The “Obstacle Database” displayed “N/A” for its expiration date. Figure 4 shows the unit’s database page.

Figure 4. The Garmin GNS-530W’s database page.

The device was then changed to the “NAV” page which displayed the unit’s stored, last used, navigational and communications frequencies. The “Active” communications frequency was 122.700 MHz and the “Standby” communications frequency was 124.050 MHz. The “Active” navigational frequency was 111.15 MHz and the “Standby” navigational frequency was 109.15 MHz. Figure 5 shows the unit on the “NAV” page.

Figure 5. The Garmin GNS-530W's "NAV" page.

Figure 6 shows the device's stored waypoint communications information page for CTJ. The applicable frequencies for CTJ are shown in figure 6.

Figure 6. The Garmin GNS-530W's waypoint communications information page for CTJ.

2.3. Garmin GPSMAP 396 Device Description

The Garmin GPSMAP 396 is a battery-powered portable 12-channel GPS receiver with a 256-color TFT LCD display screen. The unit includes a built-in Jeppesen database and is capable of receiving XM satellite radio for flight information including NEXRAD radar, lightning, METARs, TAFs, and TFRs. The unit stores date, route-of-flight, and flight-time information for up to 50 flights. A flight record is triggered when groundspeed exceeds 30 knots and altitude exceeds 500 feet, and ends when groundspeed drops below 30 knots for 10 minutes or more. A detailed tracklog—including latitude, longitude, date, time, and GPS altitude information—is stored within the unit whenever the receiver has a lock on the GPS navigation signal. Position is updated within the tracklog as a function of time or distance moved, depending on how the unit has been configured. Once the current tracklog memory becomes full, new information either overwrites the oldest information or recording stops, depending on how the unit is configured. The current tracklog can be saved to long-term memory and 15 saved tracklogs can be maintained in addition to the current tracklog. Tracklog storage may be activated or de-activated at user discretion. All recorded data is stored in non-volatile memory. The unit contains hardware and software permitting the download of recorded waypoint, route, and tracklog information to a PC via a built-in serial port using the NMEA 0183 version 2.0 protocol. The unit can also communicate with external devices such as a computer using a built in USB port. An internal button-battery is used to back-up power to the internal memory and real-time clock during those periods when main power is removed.

2.3.1. Garmin GPSMAP 396 Data Recovery

Upon arrival at the Vehicle Recorder Laboratory, an exterior examination revealed the unit had not sustained any damage and information was extracted using the manufacturer's software normally, without difficulty. Figure 7 is a photo of the device as received.

Figure 7. The Garmin GPSMAP 396 as received.

2.3.2. Garmin GPSMAP 396 Parameters Provided

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

Table 1: Garmin GPSMAP 396 Data Parameters

Parameter Name	Parameter Description
Date	Date for recorded data point (MM/DD/YYYY)
Time	Time (UTC) for recorded data point (HH:MM:SS)
Latitude	Recorded Latitude (degrees)
Longitude	Recorded Longitude (degrees)

Parameter Name	Parameter Description
GPS Alt	Recorded GPS Altitude (feet (ft), MSL)
Groundspeed	Average groundspeed (knots (kts))
Track	Average true course (degrees)

Note: MSL means altitude above mean sea level

2.3.3. Garmin GPSMAP 396 Data Description

The data extracted included 43 sessions from February 6, 2015 through September 7 2016 (10,000 total data points). The accident flight was the 43rd session, recorded starting at 13:15:04 UTC and ending at 14:48:00 UTC on September 7 2016 (459 total data points).

Figure 8 is north-up overview of the entire accident flight generated in Google Earth. The recording began at 13:15:04 UTC and ended at 14:48:00 UTC just short of runway 35 at CTJ. Time, altitude, and groundspeed information is given every 15 minutes.

Figure 9 is a Google Earth overview of the aircraft's recorded ground track in the vicinity of CTJ up until the termination of the recording. The time, altitude, and groundspeed given in knots are displayed for each recorded track point.

Figure 10 is a Google Earth overview of all historic recorded tracklog information of the device's position in the vicinity of CTJ. It could not be confirmed if the accident pilot was the user of this device for all recorded tracklog information. The accident flightlog is shown in red.

Tabular data used to generate figures 8 through 10 are included as attachment 1 in electronic comma-delimited (.CSV) format.

Figure 8. A north-up oriented Google Earth overview of tracklog information recorded for the entire accident flight.

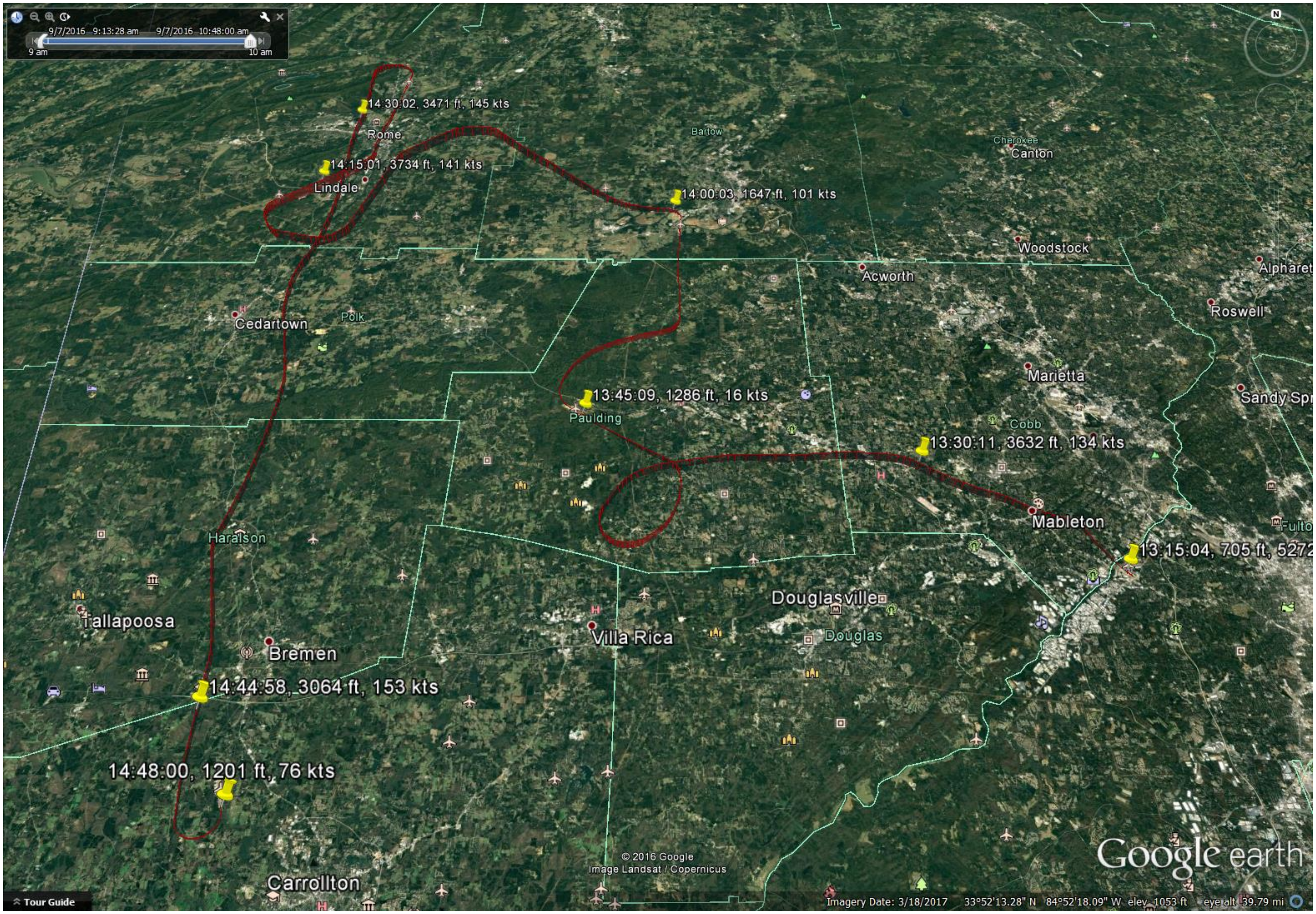

Figure 9. A Google Earth overlay showing tracklog information for the accident flight in the immediate vicinity of CTJ.

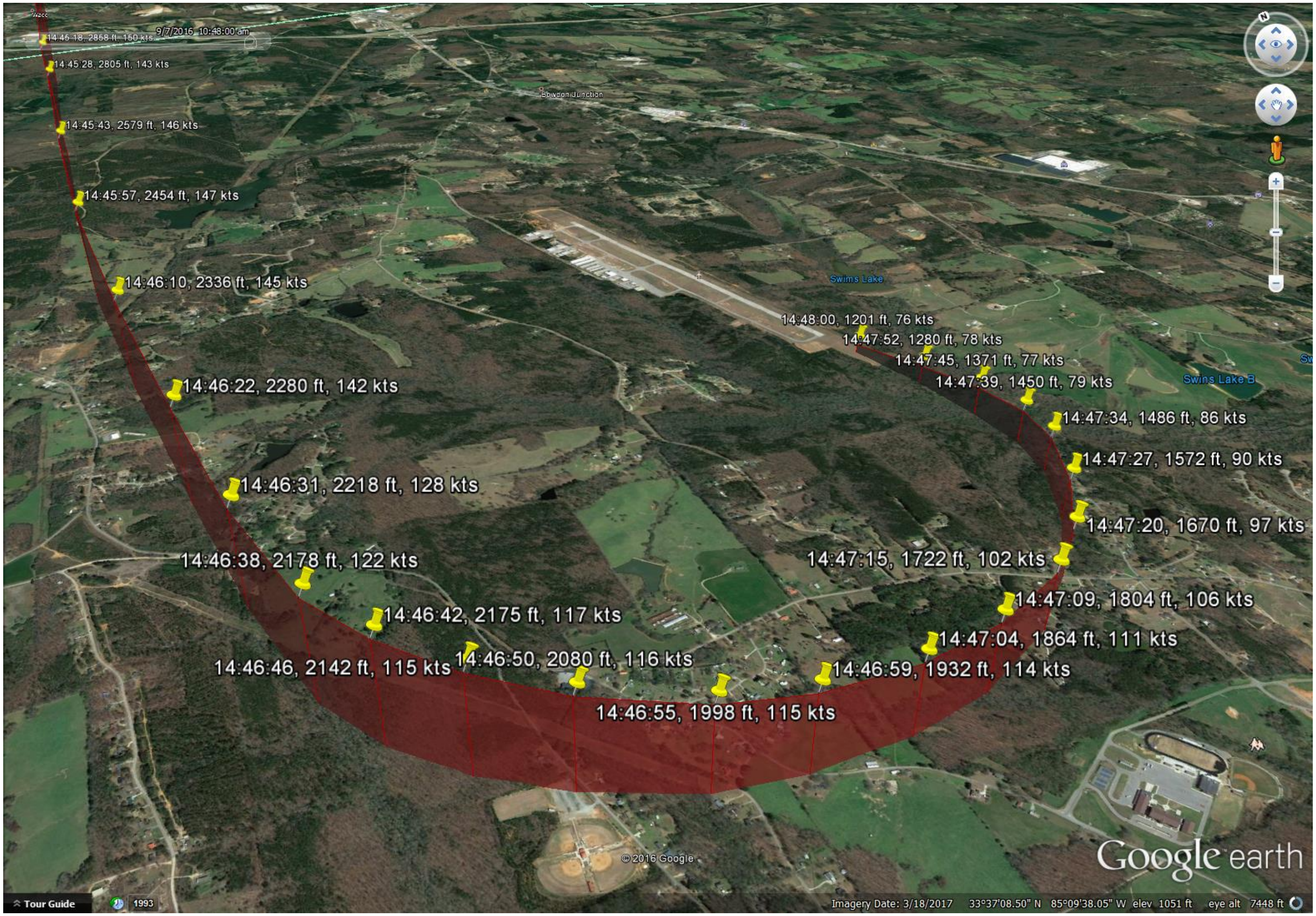

Figure 10. A Google Earth overlay showing all recorded tracklog information recorded in the vicinity of CTJ.