NATIONAL TRANSPORTATION SAFETY BOARD
Office of Research and Engineering
Washington, DC

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Recorded Radar Study (Revision # 1)

Specialist's Report of Investigation
By Alice Y. Park

MIA00FA041AB

A. A. ACCIDENT

Location:	Deland, FL.
Date:	12/03/1999
Time:	1523 UTC
Aircraft:	PA-44-180, N3038N
	PA-28-161, N153ER

B. GROUP

Not Applicable

C. SUMMARY

The original "Recorded Radar Study" dated Feb 26, 2001, is revised as follows:

1) Some radar data incorrectly associated with N153ER (i.e., two takeoffs/landings and the associated trips around the flight pattern) has been deleted.

2) Clarifying text was added to explain the differences in range/azimuth data in table 3 and 4.

On December 3, 1999, about 1523 UTC (Universal Time)[1], a Piper PA-44-180, N3038N and a Piper PA-28-161, N153ER collided in-flight near the departure end of runway 5 at the Deland Municipal-Sidney H Taylor Field Airport, Deland, Florida. Visual meteorological conditions prevailed at the time and a local Instrument Flight

[1] All radar times are given in Coordinated Universal Time (UTC) in accordance with FAA radar target reports unless otherwise stated.

Rules (IFR) flight plan was filed for the 14 CFR Part 91 instructional flight of the PA-44-180 airplane. No flight plan was filed for the 14 CFR Part 91 instructional flight of the PA-28-161 airplane; none was required. Both airplanes were destroyed and the certified flight instructor and commercial pilot-rated student of the PA-44-180 airplane were fatally injured. The certified flight instructor and private pilot-rated student of the PA-28-161 airplane were also fatally injured.

Recorded radar data for the accident aircraft were obtained from the Federal Aviation Administration's (FAA's) Daytona Beach Airport facility. The continuous Disk Recording (CDR) data provided time, range, azimuth, and altitude information for N3038N and N153ER from time 14:00:00-15:30:00 UTC.

The radar data show that N3038N descended directly to Runway 23 at Deland Municipal-Sidney H Taylor Field Airport and N153ER departed from the airport headed toward the same area in which N3038N was descending.

D. DETAILS OF INVESTIGATION

1. CDR Radar Data

CDR data on 4mm DAT tape at the Federal Aviation Administration's (FAA) Daytona Beach airport radar system facility was obtained and processed by the National Transportation Safety Board. The system recorded secondary data[2] for the accident aircraft, which included time, range, azimuth, and mode C transponder altitudes. Initially, Piper PA-44-180 (N3038N) was assigned a transponder code of 0257 and Piper PA-28-161 (N153ER) was assigned a transponder code of 0112. Both transponder code 0257 and 0112 were changed to 1200 code after radar service was terminated at 15:18:08 UTC and at 14:34:11 UTC respectively.

The FAA's Automated Radar terminal system (ARTS) IIE utilizes Airport Surveillance Radar (ASR) antennas to track aircraft within the operational area of airport. The ASR-9 antenna at nearby Daytona Beach, Florida was the closest to the accident site and has an effective range of approximately 60 NM. The time interval between target reports is related to the rotation rate of the ASR antenna, which in this case was 1 revolution per 4.5 +/- 10% seconds.

The ASR data should be assessed using the following generally accepted accuracy limits:

ALTITUDE---------- +/- 50 feet
RANGE---------- +/- 380 feet
AZIMUTH---------- +/- 2 ACP

[2] Air traffic control secondary radar systems transmit coded electromagnetic signals (interrogations) that can be received by transponder-equipped aircraft. The aircraft receives the signal, decodes it, and then transmits a coded electromagnetic signal in response to the interrogation. Secondary returns can provide information on the aircraft's identity, altitude, and position.

The altitude and range accuracy limitations are usually constant assuming the aircraft transponder was calibrated and function properly. The azimuth accuracy limit is usually constant at +/- 2 ACP: however, the actual azimuth distance limit increases with range since the arc length of 4 ACP increases linearly with range.

Range and azimuth in CDR data have been processed into latitude and longitude to trace accident aircraft. The latitudinal/longitudinal data were processed into x/y coordinates and back to range/azimuth. Tables 1 and 2 display tabular listings of latitude, longitude calculated from the CDR data, and x/y coordinates calculated from latitudinal and longitudinal data. Tables 3 and 4 provide range/azimuth processed from latitudinal/longitudinal data in tables 1 and 2. Table 5 provides data of the last three returns with tabular listings of the processed data.

Range and azimuth provided in table 3 and 4 are slightly different from the range and azimuth in CDR data due to rounding errors during processing. However, the differences do not significantly affect the result. CDR data is provided in docket separately in an electronic format, filename "CDR.txt".

2. Ground Track

The range and azimuth information found in the CDR data was processed into latitude and longitude values, and the latitude and longitude information was processed into x/y coordinates corresponding to east and north, respectively. The processed x/y data was then plotted using the Daytona Beach ASR antenna site as the origin for the plot. Communications taken from the ATC transcriptions are also inserted on the plot. Figure 1-a, 1-b, 1-c and 1-d show the plan views of the flight of N3038N for the time from 1439, 1459, 1512 and 1516 UTC to the last radar target of N3038N respectively. Figure 2 displays the plan view of the entire flight of N153ER. Figure 3 and 4 display both of aircraft from 15:12:00 UTC and 15:16:00 UTC to last radar targets respectively. In addition, the positions of Runway 16 (KDAB), Runway 23 (KDED), DONGS Intersection and Ormond Beach VORTAC are displayed on the plot for reference.

Figure 4 shows that N3038N descended straight down to airport after receiving the radar service termination communication from the controller. Flight N153ER turned to the northwest after departing Runway 5. Both aircraft transponder codes were changed to 1200 after radar service was terminated at 15:18:08 UTC and at 14:34:11 UTC for N3038N and N153ER respectively.

The CDR data of the last three targets in table 5 can't be identified positively due to the close proximity of the two aircraft.

3. Altitude and Distance Profile

The distance from the Runway 23 threshold was determined using the position of the threshold obtained from the FAA. Figure 5-a, 5-b, 5-c, and 5-d show profile views of N3038N with different time frames. Figure 6 and 7 show profile views of N3038N approach to Runway 23 (KDED), and profile views of N153ER departure from airport from 15:12:00 UTC and 15:16:00 UTC to last radar target respectively. The positions of Runway 16 (KDAB), Runway 23 (KDED), DONGS Intersection and Ormond Beach VORTAC, which obtained from FAA, are displayed on the plot for reference.

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List of Attachments and Figures: