

NATIONAL TRANSPORTATION SAFETY BOARD

Office of Research and Engineering
Washington, D.C. 20594

November 21, 2002

Flight Data Recorder Group Chairman's Solid State Flight Data Recorder Factual

A. EVENT

NTSB #: DCA02MA054
Location: Tallahassee, Florida
Date: July 26, 2002
Time: 0543 Eastern Daylight Time (EDT)
Aircraft: Boeing B727-200F, registration: N497FE
Operator: Federal Express

B. FLIGHT DATA RECORDER GROUP

Chairman: Cassandra Johnson, National Transportation Safety Board (NTSB)
Member: Joseph Bracken, Airline Pilots Association (ALPA)
Member: Eric West, Federal Aviation Administration (FAA)
Member: Don Sogga, Federal Express (FedEx)

The group convened at NTSB headquarters in Washington, D.C. on July 29, 2002 for readout of the solid state Flight Data Recorder (FDR). Group activities included decoding and verifying the FDR parameters recorded.

C. SUMMARY

On July 26, 2002, at 0545 eastern daylight time, a FedEx Boeing 727, N497FE, crashed during landing at Tallahassee, Florida. The airplane was operating as Flight 1478 from Memphis, Tennessee, to Tallahassee. The airplane crashed short of the runway, and was subsequently destroyed by fire. Two crewmembers had minor injuries and the first officer had serious injuries.

The solid state flight data recorder (FDR), Solid State Universal Flight Data Recorder part number 980-4120-KXUS with the serial number of 2343, was removed from the main wreckage

and sent to the National Transportation Safety Board's laboratory in Washington, D.C. for readout and evaluation. All 27.07 hours of recorded data were successfully downloaded. For the accident flight, the FDR data indicated the previous takeoff at Memphis, Tennessee occurred at approximately 3,560 SRN¹ with the final FDR data recorded at 7,201 (9:37:25.04² local time). Hence, the accident flight FDR data lasted approximately 1 hour and 41 seconds in duration.

Attachment I lists all data parameters recorded on the FDR. Selected FDR parameters recorded during the last 10 minutes of the accident flight are presented in Attachments II-1 to II-7 in graphical format (7 plots total). In addition, selected FDR parameters recorded during the previous takeoff at Memphis, Tennessee are presented in Attachment II-8 (1 plot total). Attachment III³ contains all the data graphed in Attachment II in comma delimited (CSV) format files.

D. DETAILS OF THE INVESTIGATION

Section I – Description of Data

This model FDR records flight information in a digital format using solid-state Flash Memory. The FDR records 64 words of digital information every second, with each word 12-bits in length. Each grouping of 64 words (1 second) is called a subframe. The first word in the subframe is a unique 12-bit synchronization (sync) word identifying it as either subframe 1, 2, 3, or 4. Each grouping of consecutive subframes 1, 2, 3, and 4 comprise a frame (e.g. four seconds of data). The data stream is "in sync" when successive sync words appear at the proper 64-word intervals. Each data parameter (e.g. altitude, heading, airspeed) has a specifically assigned word number within the subframe. Attachment I contains the list of parameters available and the associated word slot assignment.

¹ Duration of FDR recording was measured in Subframe Reference Number (SRN), where each SRN equals 1 elapsed second.

² The FDR SRN times were correlated to the Federal Aviation Administration's radar time (also known as local time). All times, unless otherwise noted, are local time in hours, minutes and seconds (HH:MM:SS). Refer to Part D Section III for details on the time correlation between the FDR SRN time and local time.

³ For this accident, Attachment III only exists as electronic files in the docket.

Section II – Readout & Evaluation

The solid state FDR was examined upon receipt and found to be in good condition. The solid state FDR data were downloaded directly to hard disk for further analysis using the National Transportation Safety Board's readout equipment. The downloaded data were converted from the recorded binary values (0's and 1's) to engineering units (for example feet, knots, degrees, etc.) using the FDR system documentation supplied by Federal Express. The actual conversion is accomplished by a process that incorporates the National Transportation Safety Board's computers and associated software.

Pressure Altitude and MSL Altitude

The FDR records Pressure Altitude, which is based on a standard altimeter setting of 29.92 inches of mercury (in Hg). The local altimeter at the time of the accident was 30.10 in Hg, not 29.92 in Hg. Therefore, 166 feet were added to the Pressure Altitude FDR values in order to obtain the Altitude above Mean Sea Level (MSL), which is referred to MSL Altitude in this report. MSL Altitude values are presented in this report, not Pressure Altitude values.

Air/Ground (MLG) Discrete

The FDR data indicated the Air/Ground MLG⁴ discrete was not functioning. During the entire recorded FDR it indicated “air” and never indicated “ground”. Therefore, Air/Ground MLG discrete data were not graphed. Staff verbally informed Federal Express of the inoperative Air/Ground MLG discrete.

Section III – Time Correlation

The Aircraft Performance Group Chairman established the time correlation between the FDR SRN to the Federal Aviation Administration (FAA) radar time (also known as local time) for the end of the accident flight. The time correlation was not used for the previous takeoff at Memphis, Tennessee FDR data since the takeoff occurred over 1 hour and 40 seconds prior to the end of the FDR. Based on the information supplied by the Aircraft Performance Group

⁴ MLG = Main Landing Gear

Chairman, the time of each FDR SRN were adjusted to local time by adding 27,444.04 seconds to each FDR SRN or

$$\text{Local Time} = \text{FDR SRN} + 27,444.04 \text{ seconds.}$$

Refer to the Performance Study for more details.

Section IV – Plots and Data in Electronic Format

Selected FDR parameters pertinent to the accident flight are presented in Attachment II in graphical format. There are a total of 8 plots where 7 plots are from the last 10 minutes of the accident flight (Attachments II-1 to II-7) and 1 plot is from the previous takeoff in Memphis, Tennessee (Attachment II-8). Attachments II-1, II-2, II-3 and II-8 contain selected general flight FDR parameters. Attachments II-4, II-5 and II-6 contain selected flight control FDR parameters. Lastly, Attachment II-7 contains selected discrete FDR parameters.

Attachments II-1, II-4 and II-7 have a time scale from 09:27:00 to 09:37:30 (the last 10 minutes of FDR data). Attachments II-2 and II-5 have a time scale from 09:35:00 to 09:37:30 (the last 2.5 minutes of FDR data). Lastly, Attachments II-3 and II-6 have a time scale from 09:36:25 to 09:37:25 (the last minute of FDR data). Attachment II-8 has a time scale from 3,455 to 3,605 FDR SRN.

Attachment III contains all the data graphed in Attachment II in comma delimited (CSV) format files.

Cassandra Johnson
Mechanical Engineer
FDR Specialist

Enclosures:

- Attachment I: FDR Parameter Listing
- Attachment II: Selected FDR Data Plotted (8 Plots Total)
- Attachment III: FDR Data for Attachment II in Comma Delimited (CSV) Format Files