

National Transportation Safety Board

Office of Research and Engineering

Washington, DC 20594



DCA24LA316

FLIGHT DATA RECORDER

Specialist's Factual Report

February 20, 2025

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A. ACCIDENT

Location: Dunnigan, CA
Date: September 19, 2024
Time: 1247 pacific daylight time (PDT)
Airplane: Boeing 757-224, United Airlines, N12125

B. FLIGHT DATA RECORDER SPECIALIST

Specialist Tatum Butler
Recorder Specialist
National Transportation Safety Board (NTSB)

C. FEDERAL CARRIAGE REQUIREMENTS

The event aircraft, N12125, was operating under Title 14 *Code of Federal Regulations* (CFR) Part 121. The event aircraft was manufactured in 1998 and was operating such that it was required to be equipped with a flight data recorder (FDR) that recorded, at a minimum, 34 parameters, as cited in 14 CFR Part 121.344(d).

D. DETAILS OF THE INVESTIGATION

A FDR group was not convened. The NTSB Vehicle Recorder Division received the following FDR:

Recorder Manufacturer/Model:	Loral/Fairchild F1000 64 wps
Part Number:	S800-2000-00
Recorder Serial Number:	01863

1.0 Recorder Description

This model FDR records airplane flight information in a digital format using solid-state flash memory as the recording medium. The F1000 can receive data in the ARINC 573/717/747/542a configurations and can record a minimum of 25 hours of flight data. It is configured to record 64 12-bit words of digital information every second. Each grouping of 64 words (each second) is called a subframe. Each subframe has a unique 12-bit synchronization (sync) word identifying it as subframe 1, 2, 3, or 4. The sync word is the first word in each subframe. The data stream is "in sync" when successive sync words appear at proper 64-word intervals. Each data parameter (e.g. altitude, heading, airspeed) has a specifically assigned word number within the subframe. The F1000 is designed to meet the crash-survivability requirements of TSO-C124.

1.1 Recorder Condition

The recorder was in good condition and the data were extracted normally from the recorder.

1.2 Recording Description

The FDR recording contained approximately 59 hours of data. Timing of the FDR data is measured in subframe reference number (SRN), where each SRN equals one elapsed second. The event flight was the third to last flight of the recording, and its duration was approximately 5 hours and 55 minutes. The parameters evaluated for the purpose of this report appeared to be in accordance with federal FDR carriage requirements.

1.3 Engineering Unit Conversions

The engineering unit conversions used for the data contained in this report are based on documentation from the operator. Where applicable, the conversions have been changed to ensure that the parameters conform to the NTSB's standard sign convention that climbing right turns are positive (CRT=+).¹

Table 1 lists the FDR parameters verified and provided in this report. Additionally, table 2 describes the unit and discrete state abbreviations used in this report.

1.4 Time Correlation

Correlation of the FDR data from SRN to the event local time, pacific daylight time (PDT), was established by using the recorded Greenwich mean time (GMT) Hours, GMT Minutes, and GMT Seconds and then applying an additional 7 hours offset to change GMT to PDT.²

Accordingly, the time offset for the event flight data from SRN to PDT is the following: $PDT = SRN - 125404.375$. Therefore, for the rest of this report, all times are referenced as PDT, not SRN.

¹ CRT=+ means that for any parameter recorded that indicates a climb or a right turn, the sign for that value is positive. Also, for any parameter recorded that indicates an action or deflection, if it induces a climb or right turn, the value is positive. Examples: Right Roll = +, Left Aileron Trailing Edge Down = -, Right Aileron Trailing Edge Up = +, Pitch Up = +, Elevator Trailing Edge Up = +, Right Rudder = +.

² GMT is Greenwich mean time which is also known as coordinated universal time (UTC).

E. FIGURES AND TABULAR DATA

Figures 1 through 3 contain FDR data recorded during the event on September 19, 2024. All the parameters listed in table 1 are plotted in figures 1 through 3 except GMT Hours, GMT Minutes, and GMT Seconds.

Figure 1 depicts an overview of basic parameters for the entire flight, lasting roughly 6 hours, between 7:10:00 to 13:12:00 PDT on September 19, 2024.

Figure 2 depicts 5 minutes of FDR data from 12:45:00 to 12:50:00 PDT, immediately before and after the in-flight event.

Figure 3 depicts a zoomed in window of 1 minute and 20 seconds of FDR data from 12:46:45 to 12:48:05 PDT including the time of the TCAS alerts and the subsequent maneuver.

These figures are configured such that right turns are indicated by the trace moving toward the bottom of the page, left turns towards the top of the page, and nose up attitudes towards the top of the page.

The FDR data show that the aircraft was descending under 32,000 feet when the Traffic Alert and Collision Avoidance System (TCAS) alerts indicated. At 12:47:04 PDT, the TCAS Up Advisory indicated Don't Descend, and at 12:47:06 PDT, the TCAS Combined Control indicated Up Advisory Corrective. Within those two seconds, the autopilot warning and master warning discrete parameters transitioned to Warn, the autopilot warn-2 systems disconnected, and all three autopilot commands switched off. At the same time, the pitch angle increased from -1.76 degrees to 2.81 degrees. The vertical load factor reached a maximum factor of 2.3208 G's and a minimum of 0.6014 G's during this event.

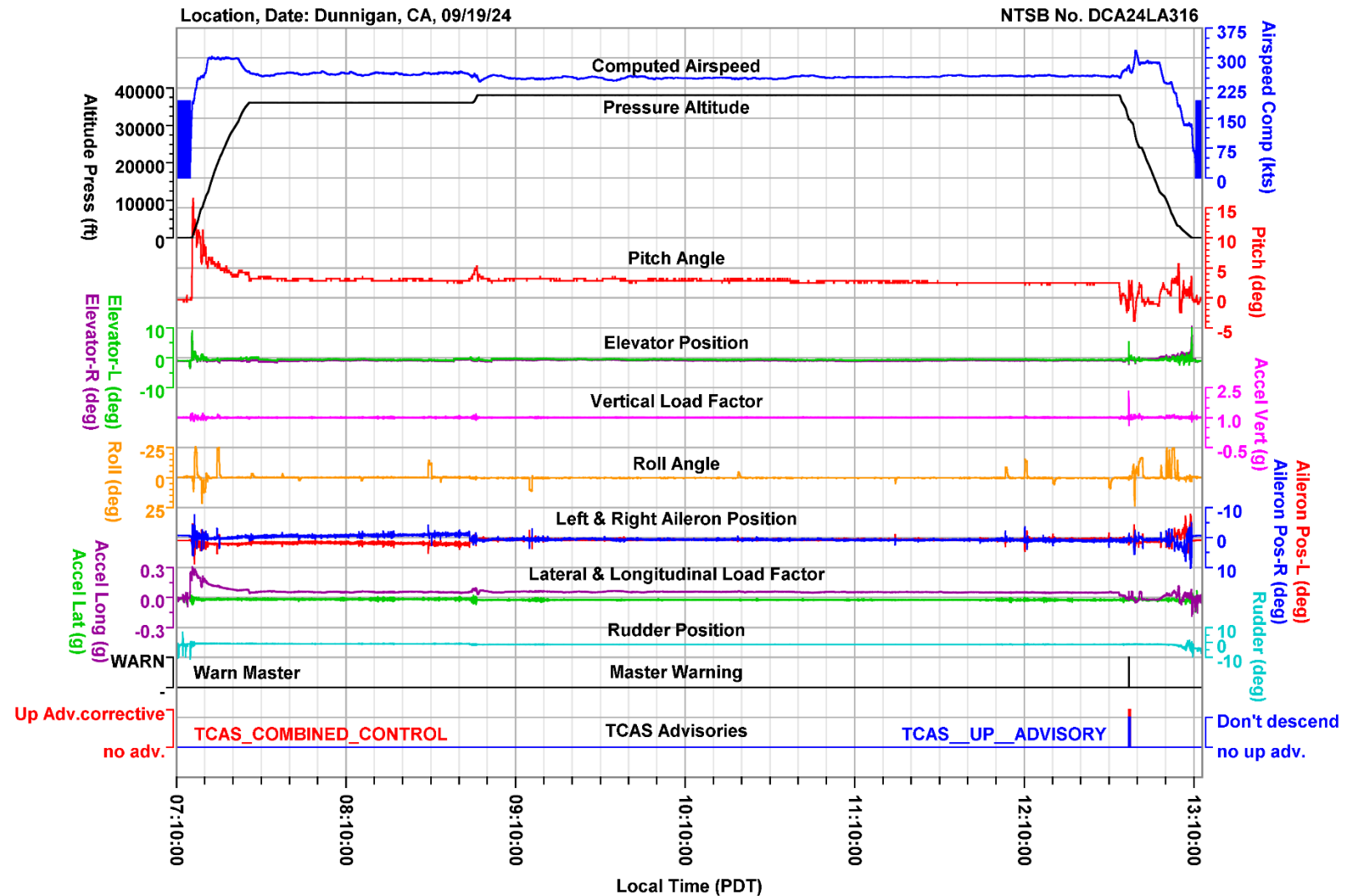
Within the following 5 seconds, the autothrottle disengaged and disconnected, and the autopilot and master warnings turned off. All discrete parameters, control surfaces, and flight parameters had returned close to their initial state within the following minute.

The corresponding tabular data used to create figures 1 through 3, including GMT Hours, GMT Minutes, and GMT Seconds, are provided in electronic comma-separated value (CSV) format as attachment 1 to this report.

Submitted by:

Tatum Butler
Recorder Specialist

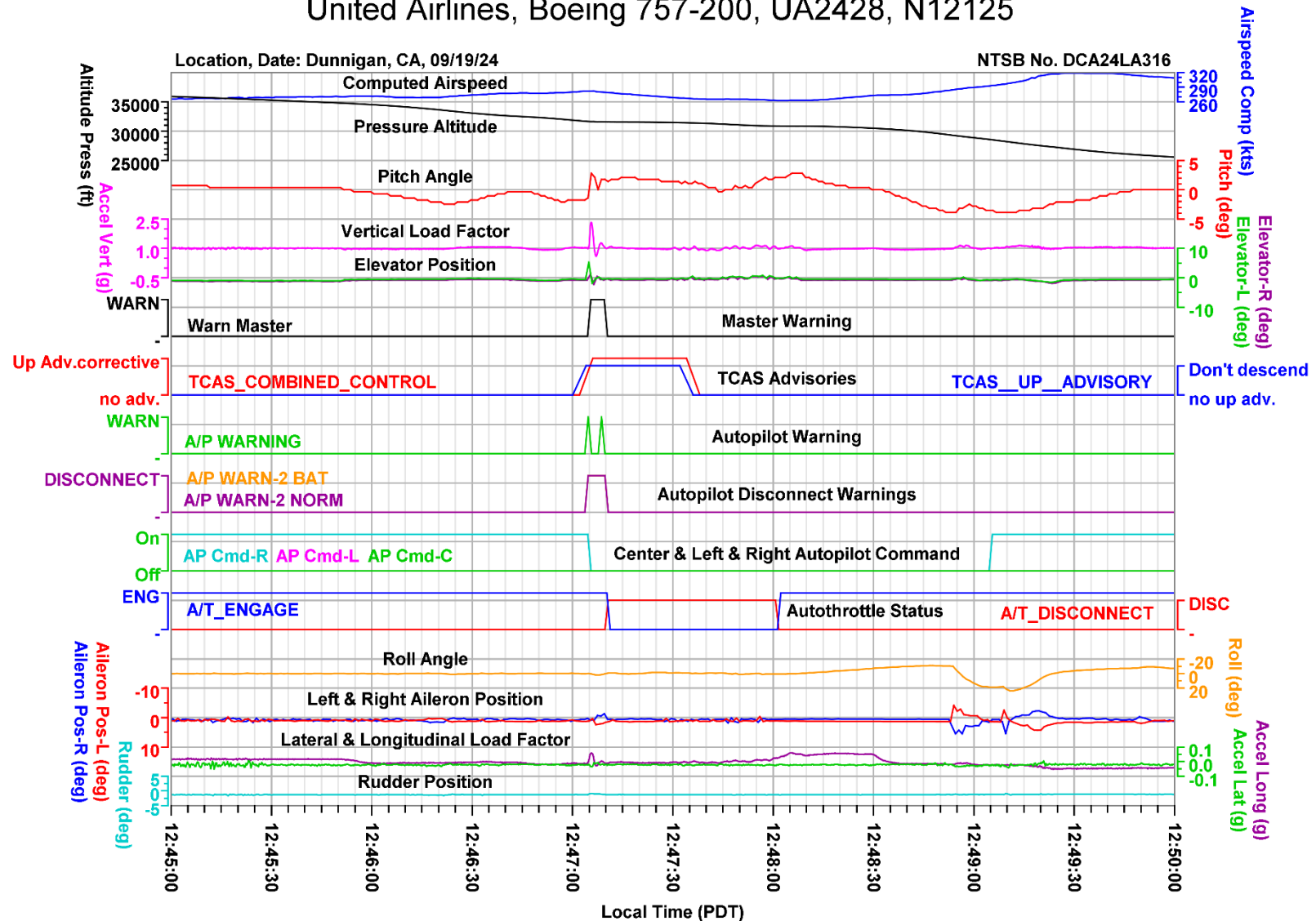
United Airlines, Boeing 757-200, UA2428, N12125



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Figure 1. Plot of basic parameters from the entire flight on September 19, 2024.

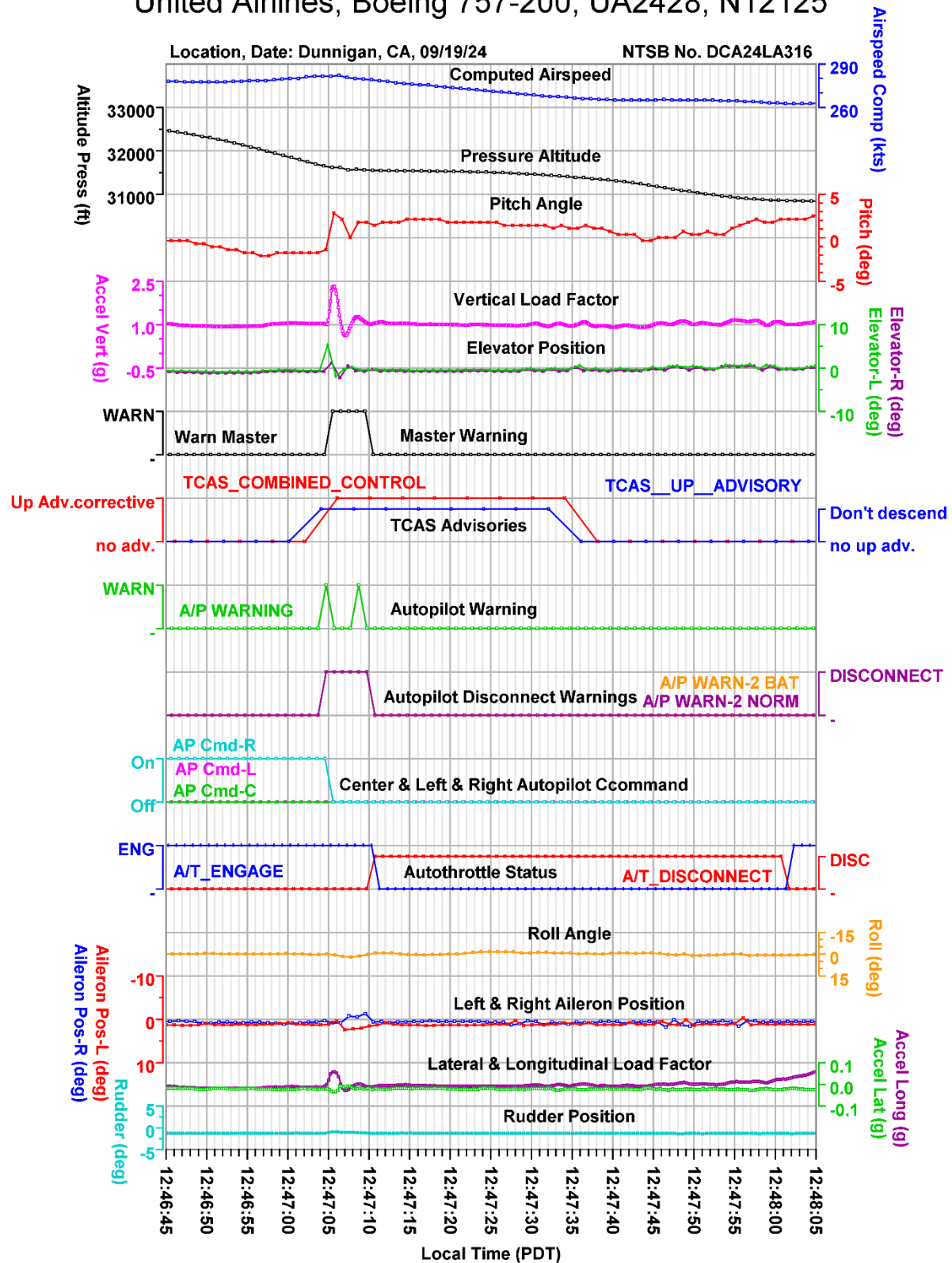
United Airlines, Boeing 757-200, UA2428, N12125



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Figure 2. Plot of selected verified parameters during the event flight.

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Figure 3. Zoomed in plot of the in-flight event.

APPENDIX

This appendix describes the parameters provided and verified in this report. Table 1 lists the plot/table labels, parameter names, and units. Additionally, table 2 describes the unit and discrete state abbreviations used in this report.

Table 1. Verified and provided FDR parameters.

Plot/Table Labels	Parameter Names	Units
Accel Lat	Lateral Load Factor	g
Accel Long	Longitudinal Load Factor	g
Accel Vert	Vertical Load Factor	g
Aileron Pos-L	Left Aileron Position	deg
Aileron Pos-R	Right Aileron Position	deg
Airspeed Comp	Computed Airspeed	kts
Altitude Press	Pressure Altitude	ft
AP Cmd-C	Center Command Autopilot	
AP Cmd-L	Left Command Autopilot	
AP Cmd-R	Right Command Autopilot	
AP Warning	Autopilot Warning	
AP Warn-2 Bat	Autopilot Warning-2 Battery	
AP Warn-2 Norm	Autopilot Warning-2 Normal	
AT Disconnect	Autothrottle Disconnected	
AT Engage	Autothrottle Engaged	
Elevator-L	Left Elevator Position	deg
Elevator-R	Right Elevator Position	deg
Pitch	Pitch Angle	deg
Roll	Roll Angle	deg
Rudder	Rudder Position	deg
TCAS Combined Control	TCAS Combined Control	
TCAS Up Advisory	TCAS Up Advisory	
Time GMT Hrs	Greenwich Mean Time Hours	hrs
Time GMT Min	Greenwich Mean Time Minutes	min
Time GMT Sec	Greenwich Mean Time Seconds	sec
Warn Master	Master Warning	

Note: This FDR records pressure altitude, which is based on a standard altimeter setting of 29.92 inches of mercury (in Hg). The pressure altitude information presented in the FDR plots and in the electronic data has not been corrected for the local altimeter setting at the time of the event.

Note: Parameters with a blank unit description in table 1 are discretes. A discrete is typically a 1-bit parameter that is either a 0 state or a 1 state where each state is uniquely defined for each parameter.

Table 2. Unit and discrete state abbreviations.

Unit and Discrete State Abbreviations	Descriptions
deg	degrees
Disc	Disconnected
Eng	Engaged
ft	feet
g	unit of gravitation acceleration
hrs	hours

Unit and Discrete State Abbreviations	Descriptions
kts	knots
min	minutes
sec	seconds