

NATIONAL TRANSPORTATION SAFETY BOARD

Vehicle Recorder Division

Washington, D.C. 20594

May 6, 2015

Flight Data Recorder - 10

Specialist's Factual Report

By Bill Tuccio

1. EVENT SUMMARY

Location: El Paso, Texas
Date: July 27, 2012
Aircraft: Boeing 737-3H4
Registration: N379SW
Operator: Southwest Airlines
NTSB Number: DCA12IA113

On July 27, 2012, about 1414 mountain daylight time (MDT), Southwest Airlines flight 1871, a Boeing 737-3H4, registration N379SW, experienced a structural failure of the nose gear actuator retract beam when the landing gear was selected down during approach to El Paso International Airport (ELP), El Paso, Texas. There were no injuries to the 71 passengers and 5 crewmembers on board and the airplane sustained minor damage. The flight was operating under the provisions of Title 14 *Code of Federal Regulations* (CFR) Part 121 on a regularly scheduled passenger flight from Las Vegas McCarran International Airport (LAS), Las Vegas, Nevada to ELP. Visual meteorological conditions prevailed at the time.

2. FLIGHT DATA RECORDER GROUP

A flight data recorder (FDR) group was not convened.

3. FDR CARRIAGE REQUIREMENTS

The event aircraft, N379SW, was manufactured on February 22, 1994, and was operating such that it was required to be equipped with an FDR that recorded, at a minimum, 34 parameters, as cited in 14 CFR Part 121.344 Appendix M.

4. DETAILS OF FLIGHT DATA RECORDER INVESTIGATION

The Safety Board's Vehicle Recorder Division received the following FDR:

Recorder Manufacturer/Model: **Allied Signal 6022**
Recorder Serial Number: **0832**

4.1. Allied Signal 6022 Description

The Allied Signal Solid State Flight Data Recorder (SSFDR) records airplane flight information in a digital format using solid-state flash memory as the recording medium.

The SSFDR can receive data in the ARINC 573/717/747 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 either 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 SSFDR is designed to meet the crash-survivability requirements of TSO-C124.

4.1.1. Recorder Condition

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

4.1.2. Recording Description

The FDR recording contained approximately 27.2 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 last flight of the recording and its duration was approximately 1 hour and 37 minutes. The parameters evaluated for the purpose of this report appeared to be in accordance with the federal FDR carriage requirements.

4.1.3. Engineering Units Conversions

The engineering units conversions used for the data contained in this report are based on documentation from the operator of the aircraft. 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

Appendix A lists the FDR parameters verified and provided in this report.

4.2. Time Correlation

Correlation of the FDR data from SRN to the event local time, MDT, was established by using the recorded Time GMT² Hours, Time GMT Minutes, and Time GMT Seconds and then applying an additional 6 hours offset to change GMT to MDT.

Accordingly, the time offset for the event flight data from SRN to local MDT is the following: MDT = SRN – 46735.0. Therefore, for the rest of this report, all times are referenced as MDT, not SRN.

4.3. FDR Plots and Corresponding Tabular Data

The following three figures contain FDR data recorded during the July 27, 2012 event.

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 = +, Pitch Up = +, Elevator Trailing Edge Up = +, Right Rudder = +.

² GMT is Greenwich Mean Time which is also known as Coordinated Universal Time (UTC).

Figure 1 shows the aircraft departed at about 1241 MDT and climbed to flight level 370. At about 1335 MDT, the aircraft began a descent for the ELP airport.

Figure 2 shows that when the aircraft was at 7,836 feet pressure altitude, between 1400:39 and 1400:45 MDT, the landing gear was transitioning from up and locked to down and locked. The FDR sampling rate of the gear up/down lock was only 1 sample every 4 seconds, as shown in Figure 3.

Coincident with the last sampling of the nose gear up and locked, the master caution sampled one warning at 1400:39 MDT. Following the gear transition to down, the aircraft descending to about 4,240 feet pressure altitude (about 600 feet radio altitude) while heading east. At about 1404:47 MDT, the aircraft began a climb to about 4,900 feet pressure altitude while turning right. At about 1407:15 MDT, the aircraft began to descend while turning right back towards an easterly heading. At about 1408:33 MDT, the vertical acceleration fluctuated between 1.24 and 0.79 g's in under one second, followed about 8 seconds later by the nose gear weight-on-wheels transitioning from air to ground at 1408:41 MDT.

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 corresponding tabular data used to create these three plots are provided in electronic (*.csv³) format as Attachment 1 to this report.

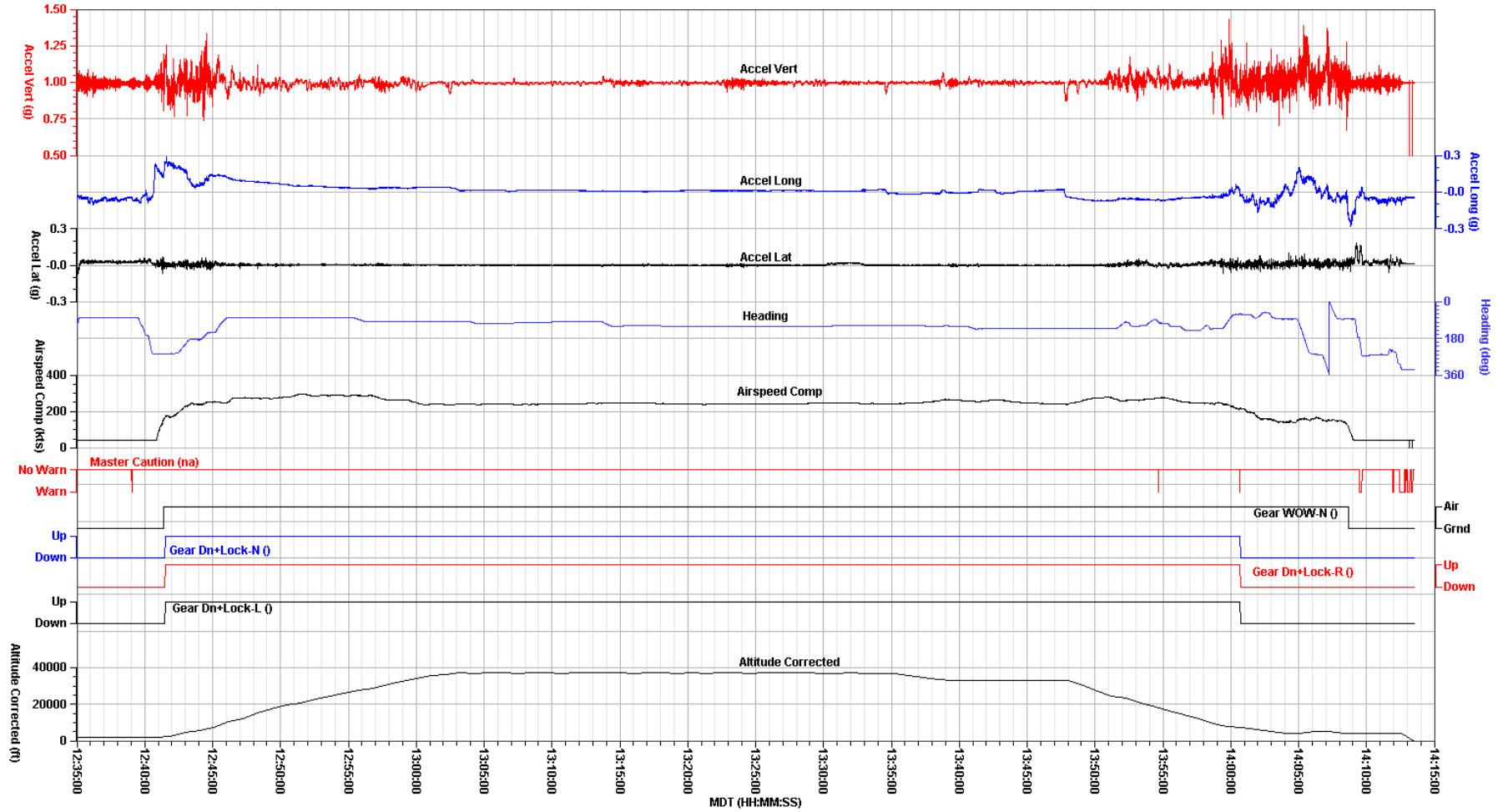
³ Comma Separated Value format.

Figure 1. Plot of basic parameters during entire flight.

Southwest Airlines, Boeing 737-300, Flight 1871, N379SW

Location, Date: El Paso, Texas, 07/27/12

NTSB No. DCA12IA113



Revised: 29 April 2013

Basic Parameters - Whole Flight

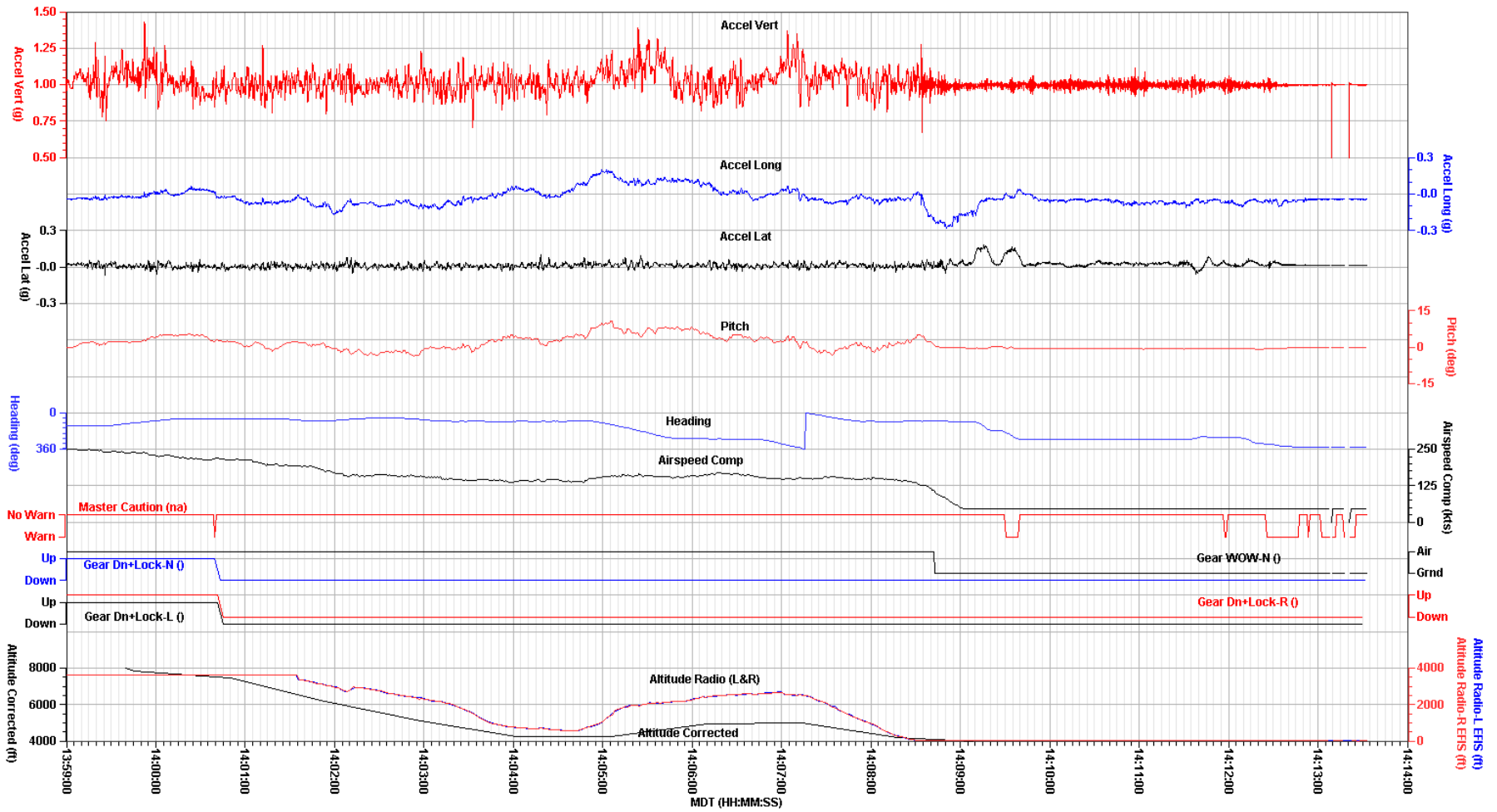
National Transportation Safety Board

Figure 2. Plot of basic parameters during approach and landing.

Southwest Airlines, Boeing 737-300, Flight 1871, N379SW

Location, Date: El Paso, Texas, 07/27/12

NTSB No. DCA12IA113



Revised: 29 April 2013

Basic Parameters - Approach and Landing

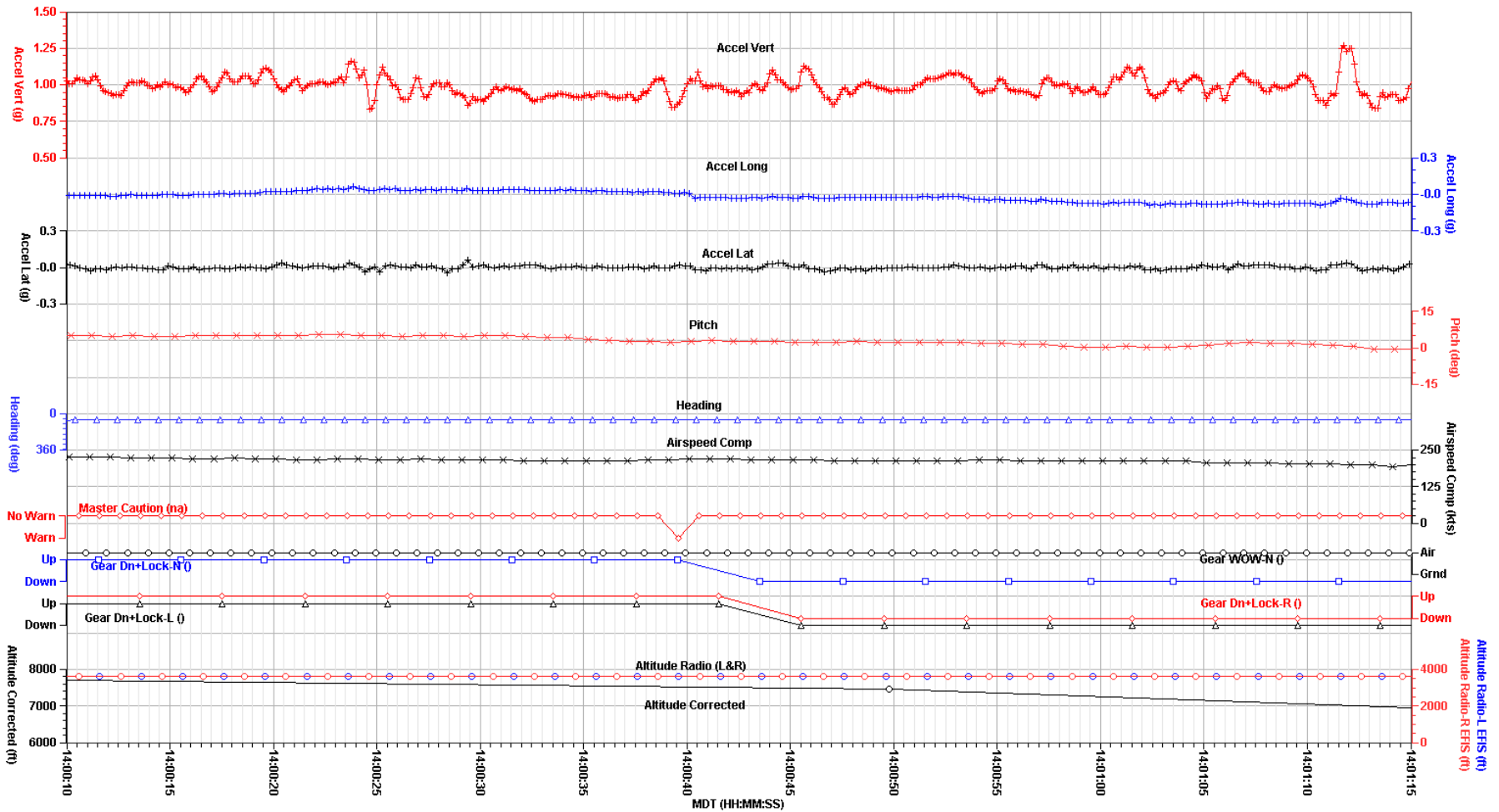
National Transportation Safety Board

Figure 3. Plot of basic parameters gear transition from up to down.

Southwest Airlines, Boeing 737-300, Flight 1871, N379SW

Location, Date: El Paso, Texas, 07/27/12

NTSB No. DCA12IA113



Revised: 29 April 2013

Basic Parameters - Gear Up to Down Transition

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APPENDIX A

This appendix describes the parameters provided and verified in this report. Table A-1 lists the parameters and table A-2 describes the unit abbreviations used in this report.

Table A-1. Verified and provided FDR parameters.

Parameter Name	Parameter Description
1. Accel Lat (g)	Lateral Acceleration
2. Accel Long (g)	Longitudinal Acceleration
3. Accel Vert (g)	Vertical Acceleration
4. Airspeed Comp (kts)	Computed Airspeed
5. Altitude Corrected (ft)	Barometric Altitude
6. Altitude Radio-L EFIS (ft)	Radio Altitude from Left EFIS
7. Altitude Radio-R EFIS (ft)	Radio Altitude from Right EFIS
8. Gear Dn+Lock-L (discrete)	Left Main Gear Down and Locked
9. Gear Dn+Lock-N (discrete)	Nose Gear Down and Locked
10. Gear Dn+Lock-R (discrete)	Right Main Gear Down and Locked
11. Gear WOW-N (discrete)	Nose Gear Weight On Wheels
12. Heading (deg)	Magnetic Heading
13. Master Caution (discrete)	Master Caution
14. Pitch (deg)	Pitch Angle
15. Time GMT Hrs (hrs)	GMT Hours
16. Time GMT Min (min)	GMT Minutes
17. Time GMT Sec (sec)	GMT Seconds

Table A-2. Unit abbreviations.

Units Abbreviation	Description
deg	degrees
kts	knots
g	g
discrete	discrete
ft	feet
hrs	hours
min	minutes
sec	seconds

NOTE: For parameters with a unit description of discrete, 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.