

# NATIONAL TRANSPORTATION SAFETY BOARD

Vehicle Recorder Division

Washington, D.C. 20594

August 18, 2009

## Flight Data Recorder - 10

### Specialist's Factual Report

By Michael Bauer

#### 1 EVENT SUMMARY

Location: Houston Hobby Texas  
Date: May 12, 2009  
Aircraft: B-737-300, N371SW  
Operator: Southwest Airlines  
Flight: 519  
NTSB Number: CEN09IA294

On May 12, 2009, at 1946 central daylight time, a Boeing 737-3H4 airplane, N371SW, operated by Southwest Airlines Co as flight 519, landed at the William P. Hobby Airport (KHOU) Houston, Texas. During the landing on runway 22 (7,602 feet by 150 feet), the airplane sustained minor damage and experienced a fire in the area of the right landing gear when three of the four main landing gear tires blew-out during touchdown. The 2 flight crew, 3 flight attendants, and 48 passengers evacuated on the runway. The domestic passenger flight was being operated under the provisions of Title 14 Code of Federal Regulations Part 121. Visual meteorological conditions prevailed and an instrument flight rules flight plan was filed. The flight originated from the Louis Armstrong New Orleans International Airport (KMSY), New Orleans, Louisiana, at 1830.

#### 2 FLIGHT DATA RECORDER GROUP

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

#### 3 DETAILS OF FLIGHT DATA RECORDER INVESTIGATION

On May 20, 2009, the Safety Board's Vehicle Recorder Division received the following FDR:

Recorder Manufacturer/Model: **Honeywell SSFDR, Model 980-4700, 64 Word**  
Recorder Serial Number: **0951**

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

### **3.1 Recorder Description**

The Honeywell 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.

### **3.2 FDR Carriage Requirements**

Federal regulations regarding the carriage requirements of FDRs on aircraft can be found in the following regulations: 14 CFR 121.343, 14 CFR 121.344, 14 CFR 121.344a and 14 CFR 135.152. In general, for turbine-powered transport category aircraft manufactured on or before October 11, 1991, an FDR must be installed on board that records a minimum of 18 parameters, and for those turbine-powered aircraft that seat between 10 and 19 passengers, the minimum is 22 parameters. Newly manufactured aircraft are required to be equipped with an FDR that records a minimum of 88 parameters. Specifically, the incident aircraft, N371SW, was operating such that it was required to be equipped with an FDR that recorded 34 parameters, as cited in 14 CFR 121.344. The incident aircraft was in compliance with the federal FDR carriage requirements.

### **3.3 Recording Description**

The FDR recording contained approximately 26 hours of data. Timing of the FDR data is measured in subframe reference number (SRN), where each SRN equals one elapsed second. The incident flight was the last flight of the recording and its duration was approximately 1 hour and 3 minutes.

### **3.4 Time Correlation**

Correlation of the FDR data from SRN to the incident local time was established with an offset from the FDR recorded Greenwich Mean Time (GMT). The incident flight data has been offset from SRN to local Central Daylight Time (CDT) by subtracting 21,677 seconds.

### **3.5 Engineering Units Conversions**

The engineering units conversions used for the data contained in this report are based on documentation from the operator and aircraft manufacturer. Where applicable, changes to the conversions have been made to ensure the parameters conform to the Safety Board's standard sign convention that climbing right turns are positive (CRT=+).<sup>1</sup>

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<sup>1</sup> 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 = +.

### 3.5.1 Parameters Provided and Verified

The following table lists the FDR parameters provided and verified in this report, including the associated plot label.

**Table 1 Verified and Provided FDR Parameters**

| <b>Plot Label</b>            | <b>FDR Parameter</b>                          |
|------------------------------|---|
| 1. Accel Lat (g)             | Lateral Acceleration (g)                      |
| 2. Accel Long (g)            | Longitudinal Acceleration (g)                 |
| 3. Accel Vert (g)            | Vertical Acceleration (g)                     |
| 4. Air-Grnd                  | Air/Ground Switch (discrete)                  |
| 5. Airspeed Comp (kts)       | Computed Airspeed (knots)                     |
| 6. Altitude Press (ft)       | Pressure Altitude (feet)                      |
| 7. Brake Main-Alt Select     | Brake Select Switch (discrete)                |
| 8. Brake Press-L (psi)       | Left Brake Pressure (pounds per square inch)  |
| 9. Brake Press-R (psi)       | Right Brake Pressure (pounds per square inch) |
| 10. Eng1 N1 Non-EIS (%RPM)   | Left Engine N1 (% RPM)                        |
| 11. Eng2 N1 Non-EIS (%RPM)   | Right Engine N1 (% RPM)                       |
| 12. Gear Dn+Lock-L           | Left Gear Down and Locked (discrete)          |
| 13. Gear Dn+Lock-N           | Nose Gear Down and Locked (discrete)          |
| 14. Gear Dn+Lock-R           | Right Gear Down and Locked (discrete)         |
| 15. Gear WOW-N               | Nose Gear Weight On Wheels (discrete)         |
| 16. Gnd Speed Non-EFIS (kts) | Ground Speed (knots)                          |
| 17. Heading (deg)            | Magnetic Heading (degrees)                    |
| 18. Heading Switch           | Heading Mag/True Switch (discrete)            |
| 19. Master Caution           | Master Caution Annunciator (discrete)         |
| 20. Pitch (deg)              | Pitch Angle (degrees)                         |
| 21. Roll (deg)               | Roll Angle (degrees)                          |

### 3.5.2 Pressure Altitude

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.

### 3.6 FDR Plots and Corresponding Tabular Data

The following four plots contain FDR data recorded during the May 12, 2009 event and table 1 lists all of the FDR parameters plotted.

Plot one contains basic aircraft parameters starting just prior to the landing gear being extended on the approach into KHOU. The plot ends approximately two minutes after engine shutdown.

Plot two contains landing gear and brake system parameters starting just prior to the landing gear being extended on the approach into KHOU. The plot ends approximately two minutes after engine shutdown.

Plot three contains a subset of plot one with an expanded time scale around the aircraft touchdown and the end of the landing roll, based on the recorded ground speed reaching zero knots.

Plot four contains a subset of plot two with an expanded time scale around the aircraft touchdown and the end of the landing roll. During the touchdown and landing roll, the maximum recorded right brake pressure was 1430 PSI at approximately 19:45:32 CDT. During the touchdown and landing roll, at approximately 19:45:31 CDT the recorded left brake pressure was 770 PSI, with a maximum recorded left brake pressure of 990 PSI at approximately 19:45:57 CDT and approximately 19:46:03 CDT.

Additionally, these plots 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.

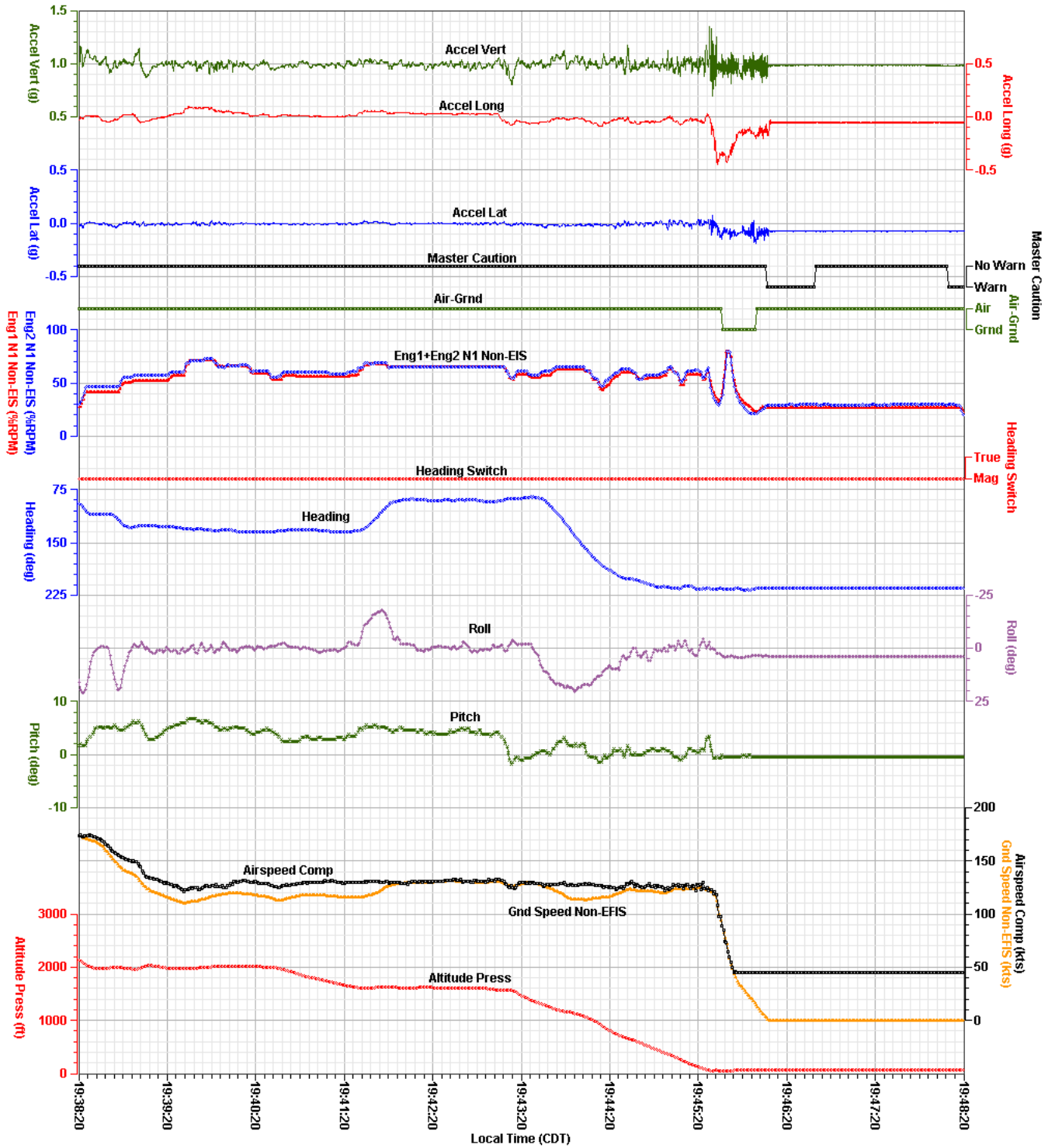
The corresponding tabular data used to create these four plots are provided in electronic (.CSV) format as Attachment 1 to this report.

# Plot 1

Southwest Airlines, Boeing B737-300, Flt 519, N371SW

Location, Date: Houston, TX, 05/12/09

NTSB No. CEN09IA294



Revised: 29 July 2009

Basic Parameters-Last 10 Minutes

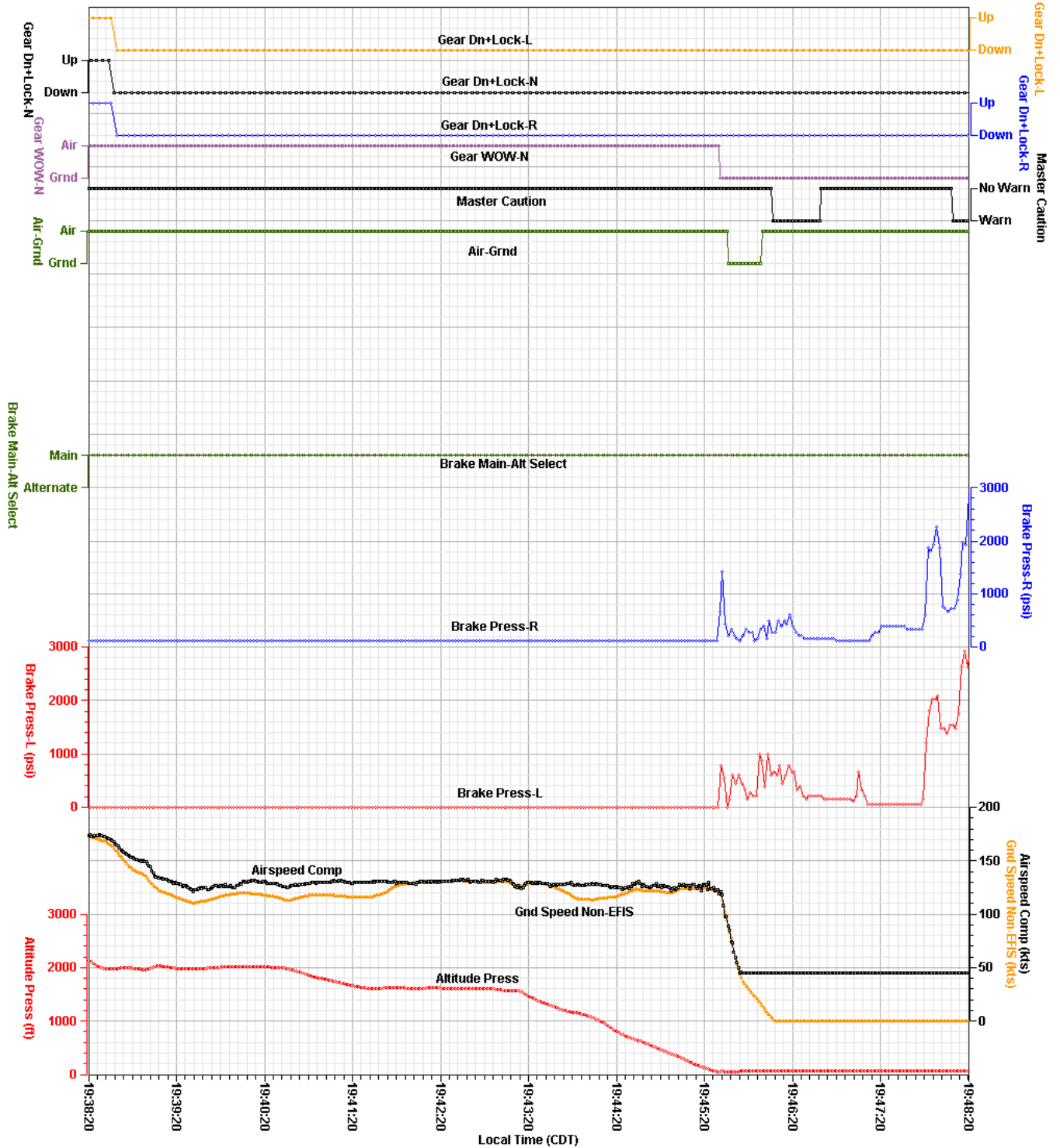
National Transportation Safety Board

# Plot 2

Southwest Airlines, Boeing B737-300, Flt 519, N371SW

Location, Date: Houston, TX, 05/12/09

NTSB No. CEN09IA294



Revised: 29 July 2009

Gear and Brake Parameters-Last 10 Minutes

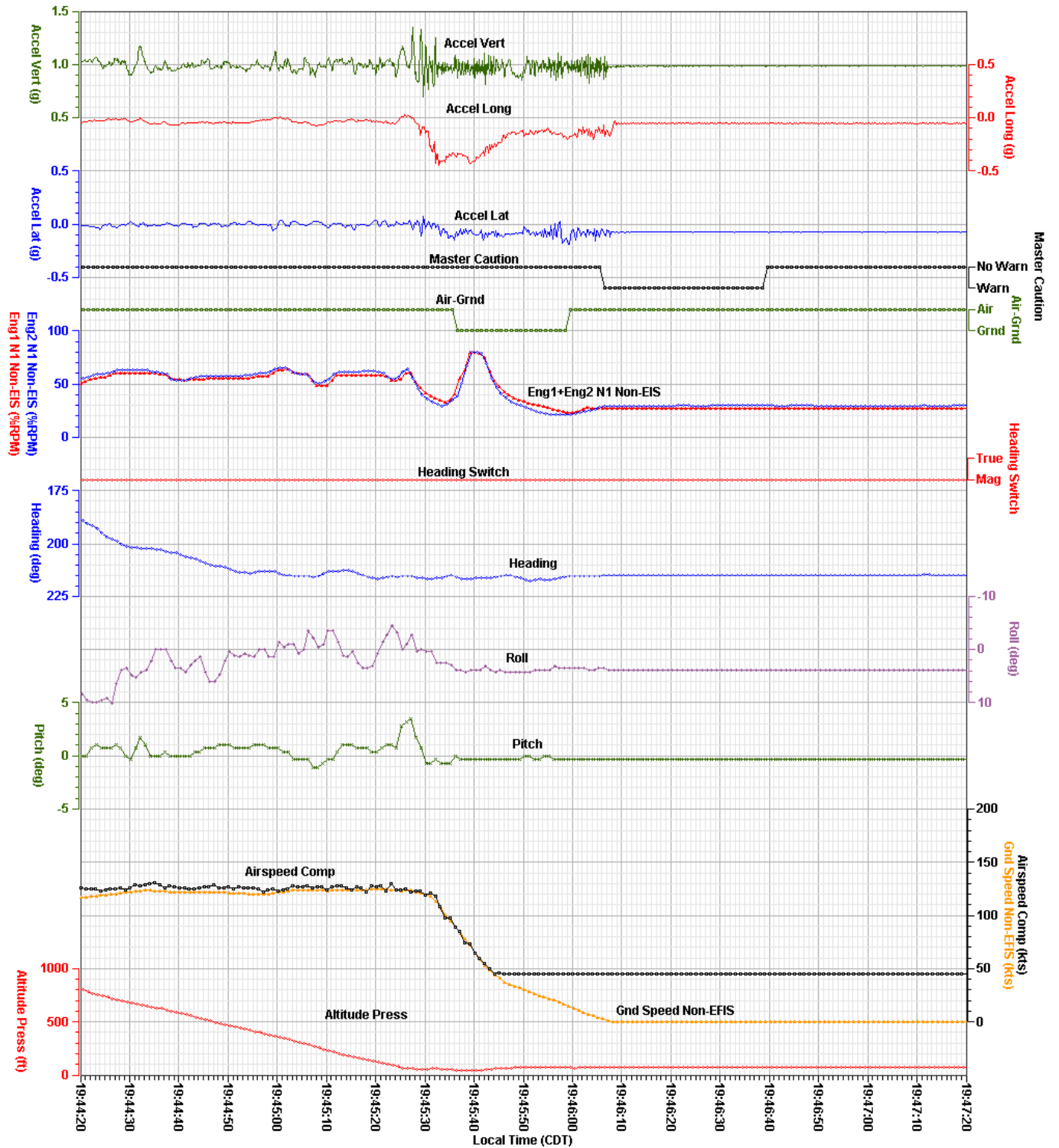
National Transportation Safety Board

# Plot 3

Southwest Airlines, Boeing B737-300, Flt 519, N371SW

Location, Date: Houston, TX, 05/12/09

NTSB No. CEN09IA294



Revised: 29 July 2009

Basic Parameters-Touchdown

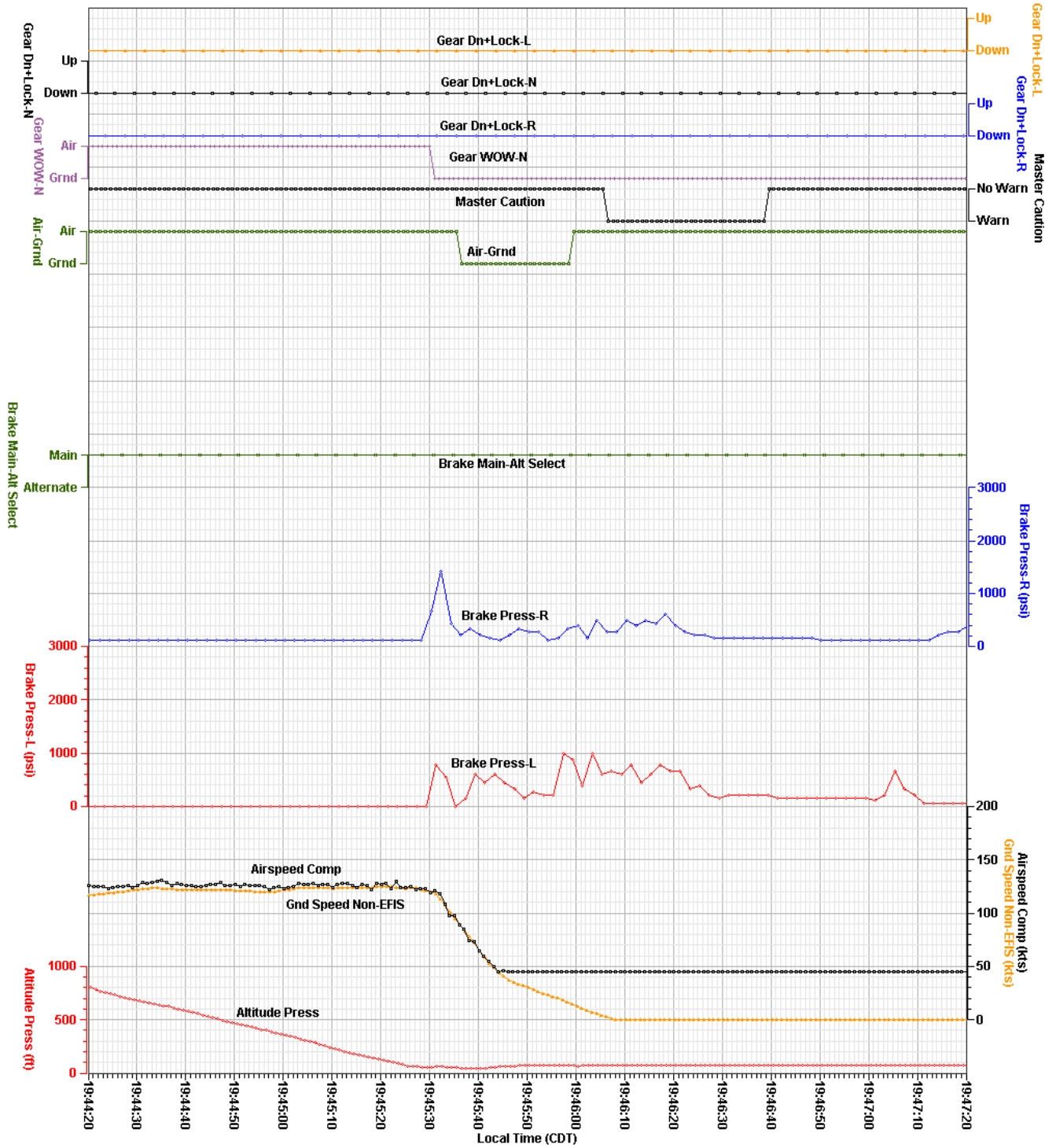
National Transportation Safety Board

# Plot 4

Southwest Airlines, Boeing B737-300, Flt 519, N371SW

Location, Date: Houston, TX, 05/12/09

NTSB No. CEN09IA294



Revised: 29 July 2009

Gear and Brake Parameters-Touchdown

National Transportation Safety Board