NATIONAL TRANSPORTATION SAFETY BOARD
Vehicle Recorder Division
Washington, D.C. 20594

February 29, 2016

Flight Data Recorder Addendum 1

Specialist's Factual Report
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1. EVENT SUMMARY

Location:	New York, New York
Date:	March 05, 2015
Aircraft:	MD-88
Registration:	N909DL
Operator:	Delta Air Lines
NTSB Number:	DCA15FA085

On March 5, 2015, about 1102 eastern standard time (EST), a Boeing MD-88, N909DL, operating as Delta Air Lines flight 1086, was landing on runway 13 at LaGuardia Airport, New York, New York, and exited the left side of the runway, contacted the airport perimeter fence, and came to rest with the airplane nose on an embankment next to Flushing Bay. The 127 passengers received either minor injuries or were not injured, and the 3 flight attendants and 2 flight crew were not injured. The airplane was substantially damaged. Flight 1086 was a regularly scheduled passenger flight from Hartsfield-Jackson Atlanta International Airport (ATL) operating under the provisions of 14 *Code of Federal Regulations* (CFR) Part 121. Instrument meteorological conditions (IMC) prevailed, and an instrument flight rules (IFR) flight plan was filed.

2. ADDENDUM

This addendum is to document the landing of the aircraft preceding the event aircraft at LaGuardia Airport. The aircraft was another Delta Air Lines Boeing MD-88, N979DL, operating as Delta Air Lines flight 1526. The data presented in this addendum was used in performance studies to compare this landing to the event.

3. DETAILS OF FDR INVESTIGATION

The National Transportation Safety Board (NTSB) Vehicle Recorder Division received the following flight data recorder (FDR):

Recorder Manufacturer/Model:	**Lockheed 209F**
Recorder Serial Number:	**4170**

NTSB's Vehicle Recorder Division also received an electronic file containing data from the Avionica Mini-QAR MKII Quick Access Recorder (QAR) installed in the N979DL aircraft.

3.1. Recorder Descriptions

For more information on the Lockheed 209F FDR and Avionica Mini-QAR MKII see the FDR Group Chairman's Factual Report. As with the event aircraft, the QAR recorded the same 64 words per second (wps) data stream from the Flight Data Acquisition Unit (FDAU) as the FDR. For similarity with the event aircraft, the QAR data was used to generate plots and perform analysis work.

3.2. Engineering Units Conversions

The engineering units conversions used for the data contained in this report are based on documentation from Delta Airlines, the aircraft 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 A-1 in appendix A lists the FDR/QAR parameters verified and provided in this report. Additionally, appendix A table A-2 describes the unit and discrete abbreviations used in this report.

3.2.1. Issues in Recorded Data

Right Brake Pressure

The right brake pressure transducer was inoperative. No right brake pressure data was available for the plots or tabular data.

Pressure Altitude

In order to capture altitude at a high enough resolution over the entire range required, the pressure altitude parameter was stored as two components in different locations in the data map. The most significant part (MSP) is stored only once every 4 seconds, while the least significant part (LSP) is stored every second. To determine the combined total pressure altitude, the MSP and LSP of the parameter are concatenated and converted to engineering units. Because the MSP was stored at a lower rate than the LSP, the resultant combined parameter data often had spikes of one to three samples as the parameter value passed through a point where the LSP wrapped. These spikes have not been corrected in the plotted or tabular data.

3.3. Time Correlation

Timing of the data is measured in subframe reference number (SRN), where each SRN equals one elapsed second. Because Coordinated Universal Time (UTC) was not recorded and there was no analysis of the Cockpit Voice Recorder (CVR) from N979DL, no attempt was made to correlate the data from recorder SRN to the event local time. Therefore, all times are referenced as 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. Exampes: Right Roll = +, Pitch Up = +, Elevator Trailing Edge Up = +, Right Rudder = +.

3.4. FDR Plots and Corresponding Tabular Data

Figures 1 to 3 contain FDR data recorded during the March 5, 2015 landing, which was immediately prior to the landing of the event aircraft, N909DL. Plotted parameters and formats are similar to those included in figures 2 to 4 of the FDR Group Chairman's Factual Report.

Figure 1 contains aircraft basic parameters, figure 2 contains deceleration aids and forces, and figure 3 contains flight controls and control surfaces. Figures 1 and 3 show the final approach from a radio altitude of 1,025 ft through landing (the x-axis scale is from 85,175 SRN to 85,305 SRN). Figure 2 has an expanded scale at landing covering 55 seconds of data from 85,240 SRN to 85,295 SRN.

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 comma separated value (*.csv) format as attachment 1 to this report.

Figure 1. Plot of basic parameters during final approach and landing.

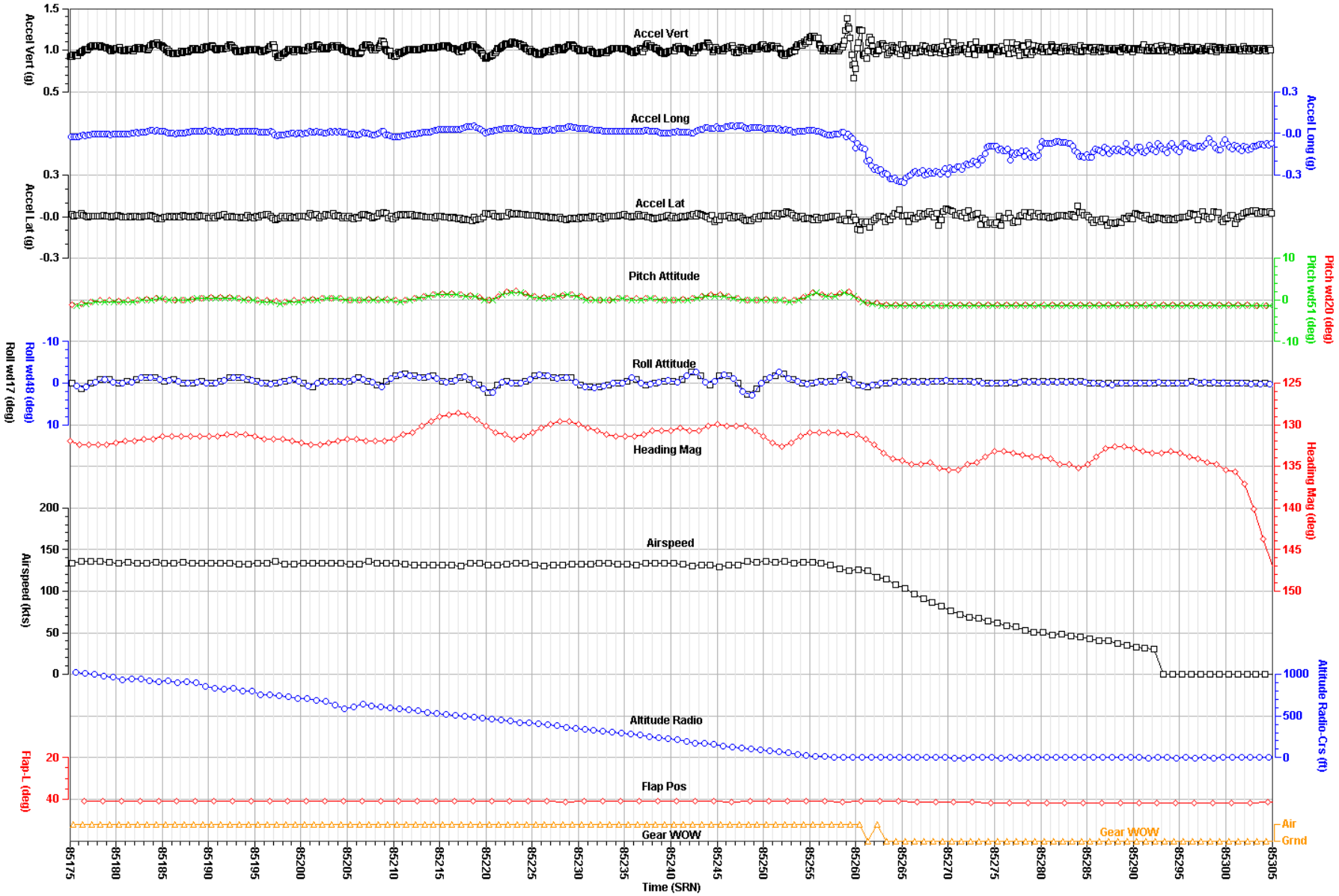


Figure 2. Plot of deceleration aids and forces around the time of landing.

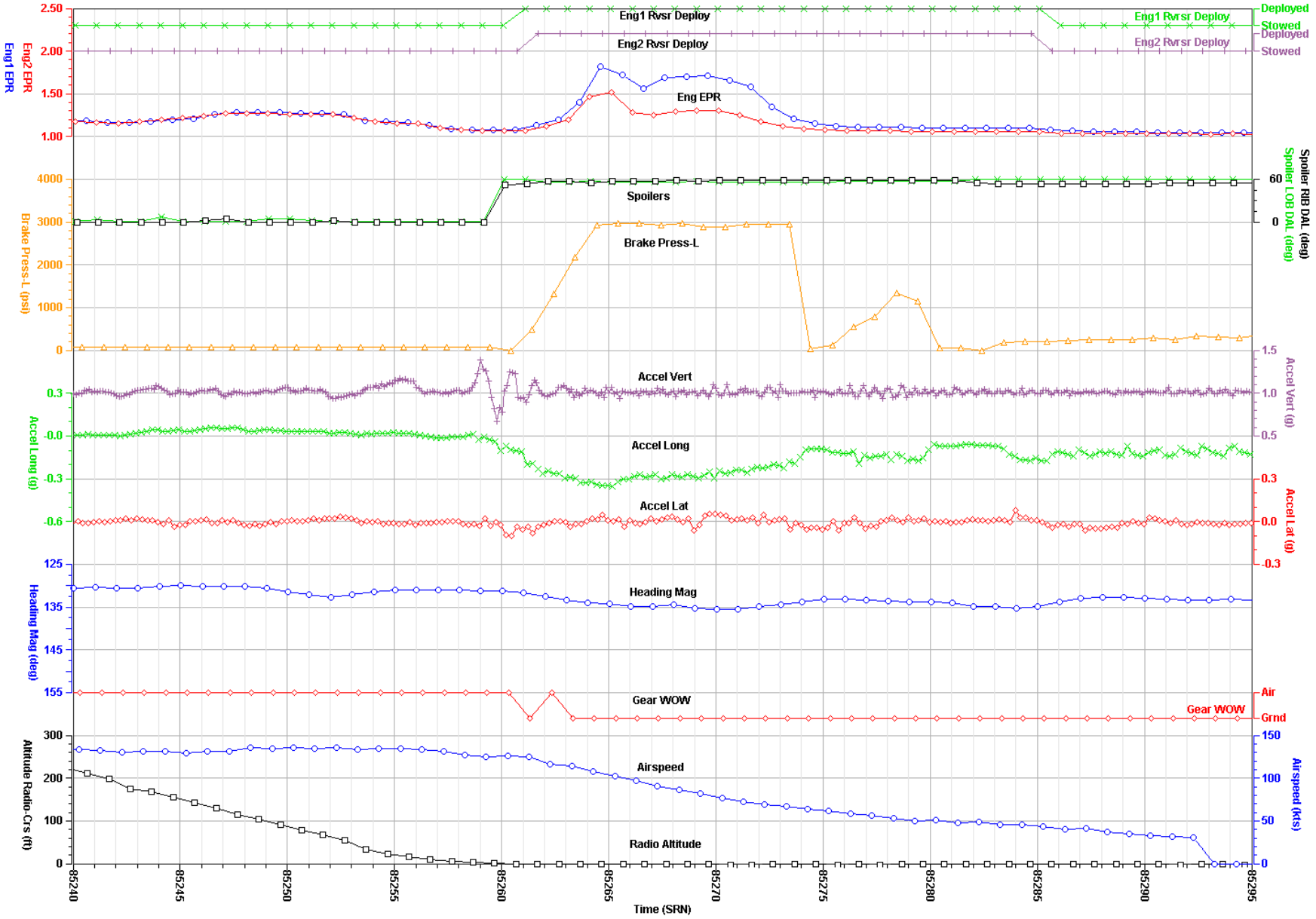
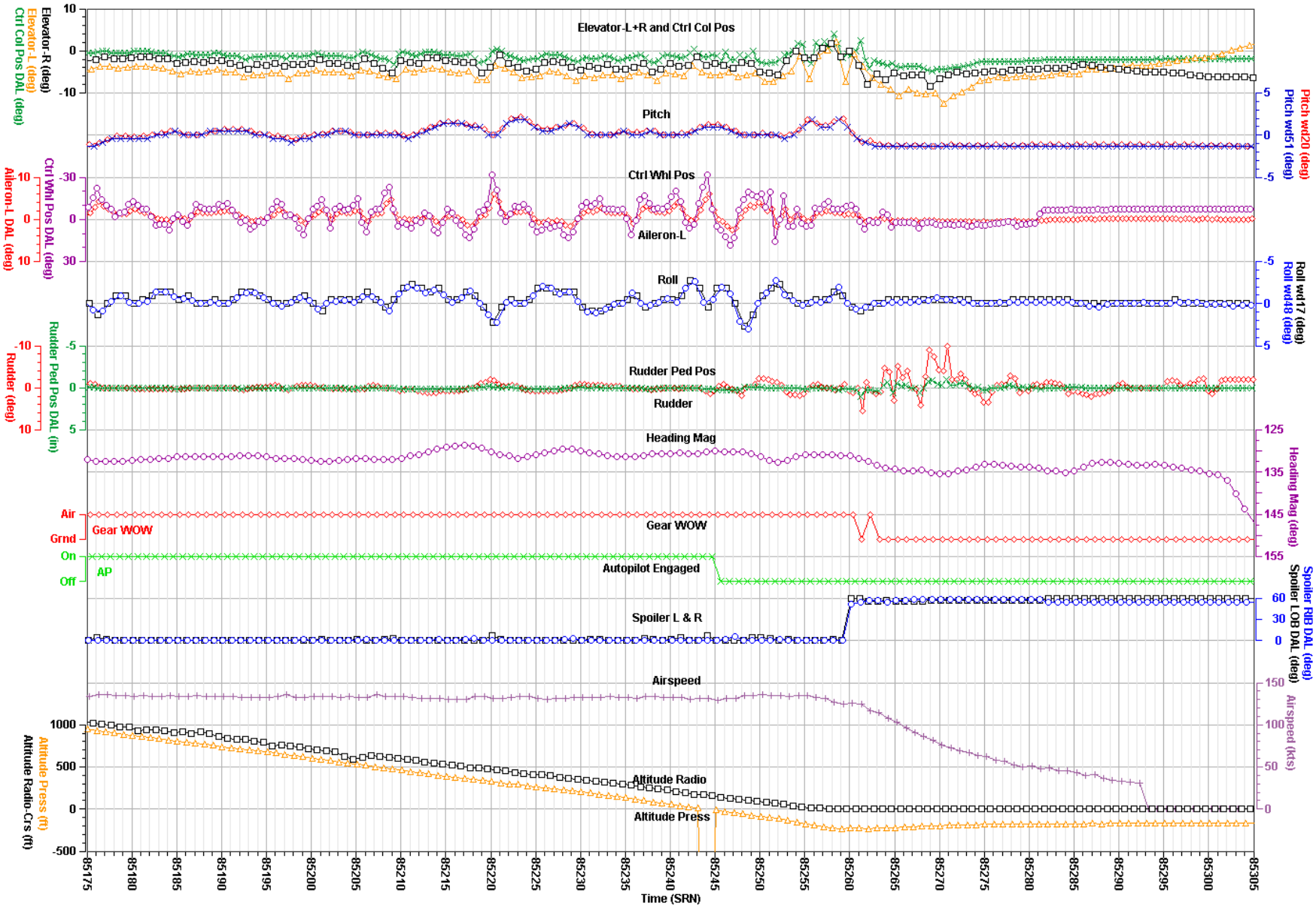


Figure 3. Plot of flight controls during final approach and landing.



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 and discrete 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. Aileron-L DAL (deg)	Left Aileron Position
5. Airspeed (kts)	Airspeed
6. Altitude Press (ft)	Pressure Altitude
7. Altitude Radio (ft AGL)	Radio Altitude
8. AP (discrete)	Autopilot Engaged
9. Brake Press-L (psi)	Left Main Gear Brake Pressure
10. Ctrl Col Pos DAL (deg)	Control Column Position
11. Ctrl Whl Pos DAL (deg)	Control Wheel Position
12. Elevator-L (deg)	Left Elevator Position
13. Elevator-R (deg)	Right Elevator Position
14. Eng1 EPR (ratio)	Engine 1 Engine Pressure Ratio
15. Eng1 Rvsr Deploy (discrete)	Engine 1 Thrust Reverser Deployed
16. Eng2 EPR (ratio)	Engine 2 Engine Pressure Ratio
17. Eng2 Rvsr Deploy (discrete)	Engine 2 Thrust Reverser Deployed
18. Flap-L (deg)	Left Flap Position
19. Gear WOW (discrete)	Gear Weight on Wheels
20. Heading Mag (deg)	Magnetic Heading
21. Pitch (deg)	Pitch Angle
22. Roll (deg)	Roll Angle
23. Rudder (deg)	Rudder Position
24. Rudder Ped Pos DAL (in)	Rudder Pedal Position
25. Spoiler LOB DAL (deg)	Left Outboard Spoiler Position
26. Spoiler RIB DAL (deg)	Right Inboard Spoiler Position

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.

Table A-2. Unit and discrete abbreviations.

Units Abbreviation	Description
deg	degrees
degC	degrees Celsius
discrete	discrete
ft	feet
g	g
grnd	ground
kts	knots
psi	pounds per square inch

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.