

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

July 30, 2015

Flight Data Recorder

Specialist's Factual Report
By Sean Payne

1. EVENT SUMMARY

Location: Conroe, TX
Date: September 19, 2014
Aircraft: Embraer EMB-505
Registration: N322QS
Operator: NETJETS SALES INC
NTSB Number: CEN14FA505

On September 19, 2014, about 0847 central daylight time (CDT), an Embraer EMB-505 airplane, N322QS, encountered soft terrain and mud after over running the runway while landing at the Lonestar Executive Airport (CXO), Conroe, Texas. Neither of the airline transport rated pilots on board were injured. The airplane was substantially damaged. The airplane was operated by Net Jets as a 14 Code of Federal Regulations Part 91 positioning flight. Instrument meteorological conditions prevailed for the flight, which was operated on an instrument flight rules flight plan. The flight originated from the Nashville International Airport (BNA), Nashville, Tennessee, at 0710.

2. FLIGHT DATA RECORDER GROUP

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

3. FDR Carriage Requirements

The event aircraft, N322QS, was manufactured on September, 09, 2013, and was operating such that it was not required to be equipped with an FDR, as it was operating under Title 14 *Code of Federal Regulations* Part 91 at the time of the occurrence and did not have 10 or more passengers.

4. DETAILS OF FDR INVESTIGATION

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

Recorder Manufacturer/Model: **L-3/Fairchild FA2100-3083**
Recorder Serial Number: **000885510**

4.1. L-3/Fairchild FA2100-3083 Description

The L-3 Cockpit Voice and Data Recorder (CVDR) is a dual function recorder providing both Flight Data Recorder (FDR) and Cockpit Voice Recorder (CVR) functions. The FDR function records airplane flight information in a digital format using solid-state flash memory as the recording medium. The FA2100 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 256 12-bit words of digital information every second. Each grouping of 256 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 256-word intervals. Each data parameter (e.g. altitude, heading, airspeed) has a specifically assigned word number within the subframe. The CVDR is designed to meet the crash-survivability requirements of TSO-C123a and TSO-C124a.

4.1.1. Recorder Condition

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

Figure 1. Exterior of flight recorder.



4.1.2. Recording Description

The FDR recording contained approximately 222 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.

4.1.3. Engineering Units Conversions

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

4.2. Time Correlation

Correlation of the FDR data from SRN to Universal Coordinated time, UTC, was established by offsetting the recorders time to recorded parameters for UTC hours, UTC minutes and UTC seconds.

Accordingly, the time offset for the event flight data from SRN to local UTC is the following: UTC = SRN - 737,360.0. Therefore, for the rest of this report, all times are referenced as UTC, not SRN.

4.3. FDR Plots and Corresponding Tabular Data

The following six figures contain FDR data recorded during the 09/19/2014 event.

Figure 2 is a plot of select performance and braking related parameters beginning approximately 12 seconds before touchdown. The aircraft was configured at flap position three as it approached touchdown on the runway. Around 1347:09, brake pedal position parameters became active, and began to increase just before touchdown. Wheel spin became active approximately one second later, and climbed rapidly, around 1347:10 for both left and right main wheels. Two seconds later, at 1347:12, speed brake surface position for both the left and right speed brakes showed the speed brakes had begun to extend and both parameters quickly reached a maximum at 1347:14. Around the same moment, all four weight on wheels discrete parameters became true, indicating the gear squat switches for both mains had become active. Between 1347:14 and 1347:24 brake pressure for the left and right mains remained below values of 1,000 psi. During this time, the pilot's left and right brake pedal position increased to about 36 mm of travel. During this time interval, IAS, groundspeed, and wheel speed for the left and right mains steadily decreased. Around 1347:24, the parking brake/emergency brake discrete became active. Immediately following this action, brake pressure for the left and right main gear plateaued around the system's maximum value of 3,000 psi. Wheel speed quickly decreased to a value of around zero knots.

Between 1347:27 and 1347:42, brake pressure for the left and right main gear remained plateaued at around the system's maximum brake pressure value of around 3,000 psi. The pilot's left and right brake pedal position also remained steady around a maximum value of around 35 mm of pedal travel. IAS and groundspeed showed a decreasing trend during this time interval. At 1347:42, a brake fail indicator discrete became active. At this time, brake pressure for the left and right main gear dropped to zero psi while the pilot's left and right brake pedal position remained near the system's maximum pedal travel value. At this

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 = +.

moment, the aircraft was experiencing measurable changes in tri-axis acceleration consistent with the aircraft departing the runway surface. IAS and groundspeed quickly dropped to approximately zero knots and the speed brake surface positions for the left and right speed brakes bleed position decrease to zero.

Data recording ended around 1347:59 and showed the aircraft at rest.

Figure 3 is a plot of select performance and braking related parameters for approximately 3 minutes before the accident occurrence. The plot shows the aircraft on approach, initially at a speed above 150 knots. Around 1344:18, the flap position increased from flap position one to flap position two. Shortly after, around 1344:38, flap position was increased from flap position two to flap position three. The flap position remained at flap position three for the rest of the approach. Around 1344:43, brake pressure for the left and right main gear briefly spiked around 3,000 psi and quickly returned to zero. During this time, pilot brake pedal position remained near a zero value. The aircraft continued on approach and its approach speed steadily decreased to approximately 130 knots while on short final.

The remainder of figure 3 shows the accident occurrence as described in figure 2 but in a compressed time scale. The time is given in UTC.

Figure 4 is a plot of select performance and braking related parameters for the first landing previous to the accident occurrence. The time is given in UTC.

Figure 5 is a plot of select performance and braking related parameters for the second landing previous to the accident occurrence. The time is given in UTC.

Figure 6 is a plot of select performance and braking related parameters for the third landing previous to the accident occurrence. The time is given in UTC.

Figure 7 is a plot of select performance and braking related parameters for the fourth landing previous to the accident occurrence. The time is given in UTC.

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 plots for the accident event only are provided in electronic comma separated value (*.csv) format as attachment 1 to this report. The time format of the tabular data is in UTC.

Figure 2. Plot of select performance and brake related parameters beginning approximately 12 seconds before the accident touchdown.

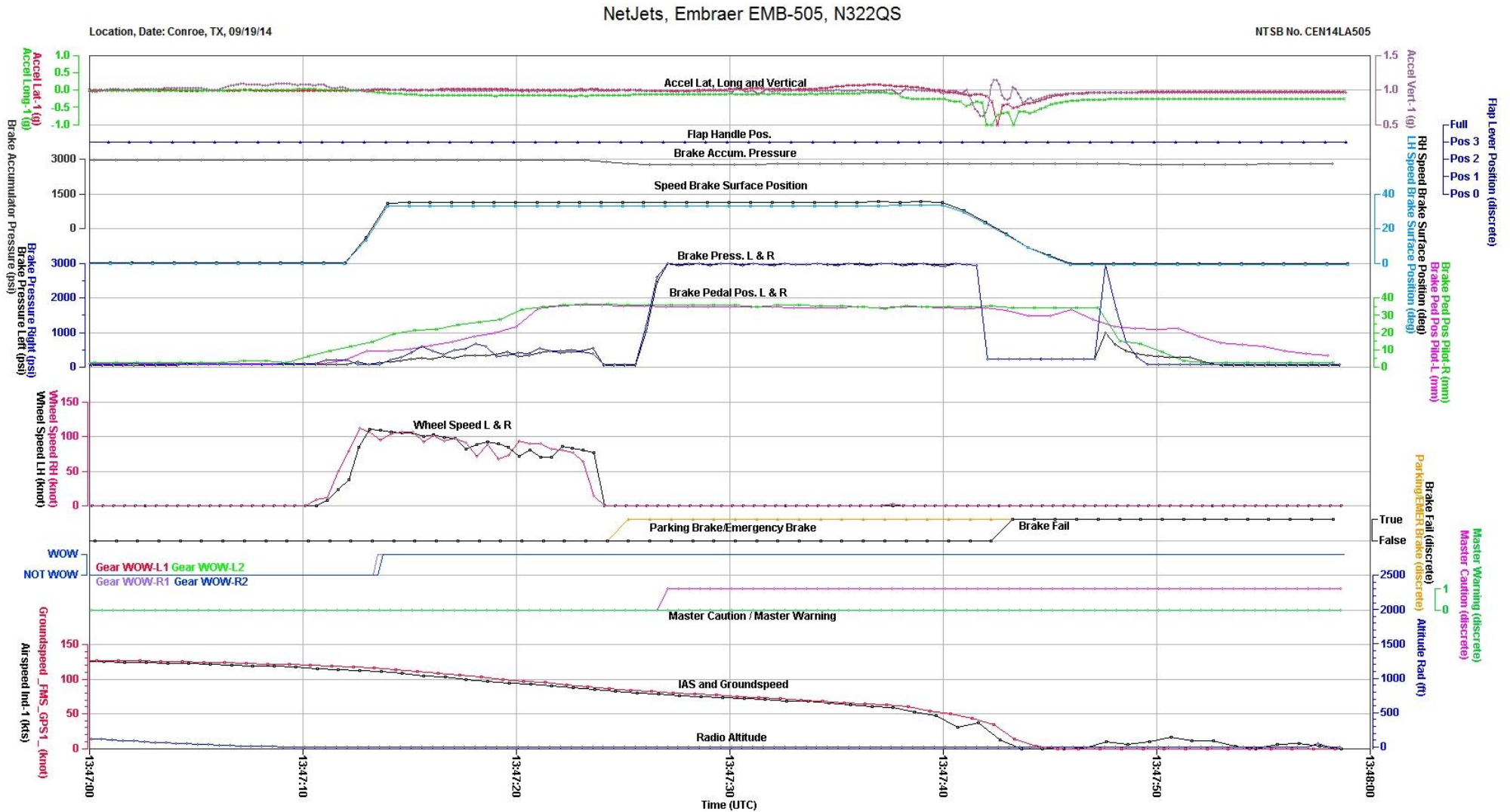


Figure 3. Plot of select performance and brake related parameters beginning 3 minutes before the accident occurrence.

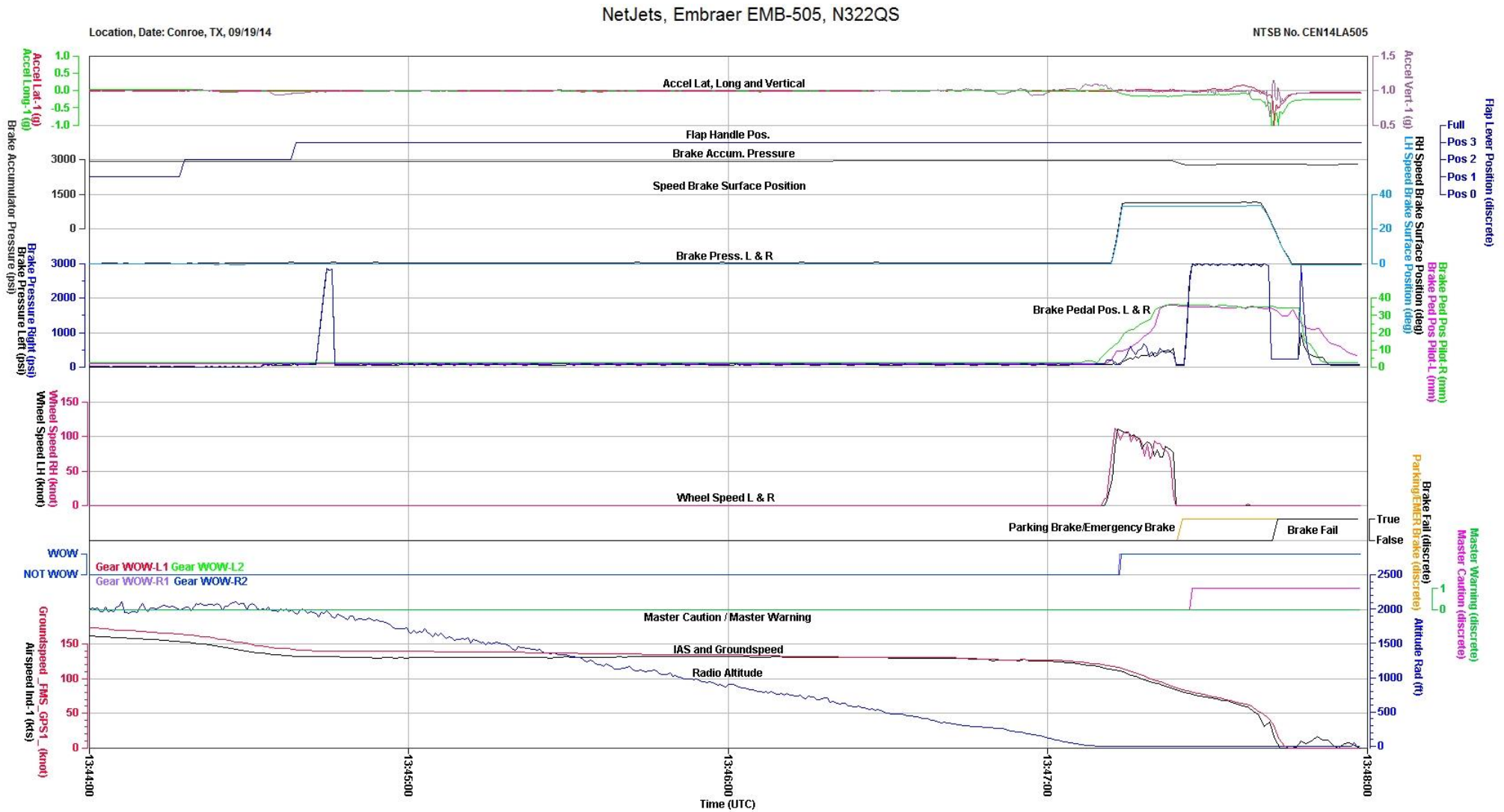


Figure 4. Plot of select performance and brake related parameters for the first previous landing.

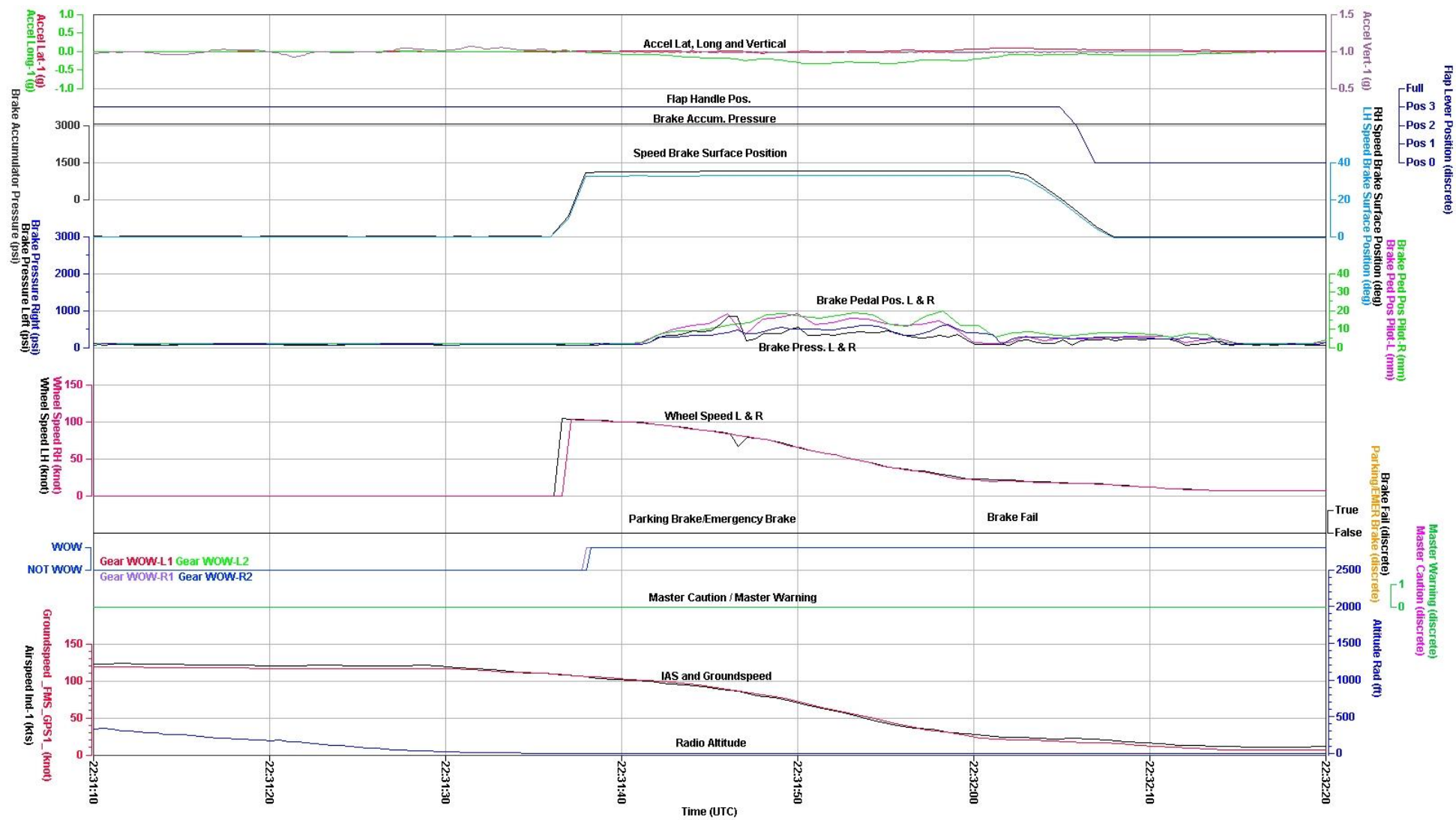


Figure 5. Plot of select performance and brake related parameters for the second previous landing.

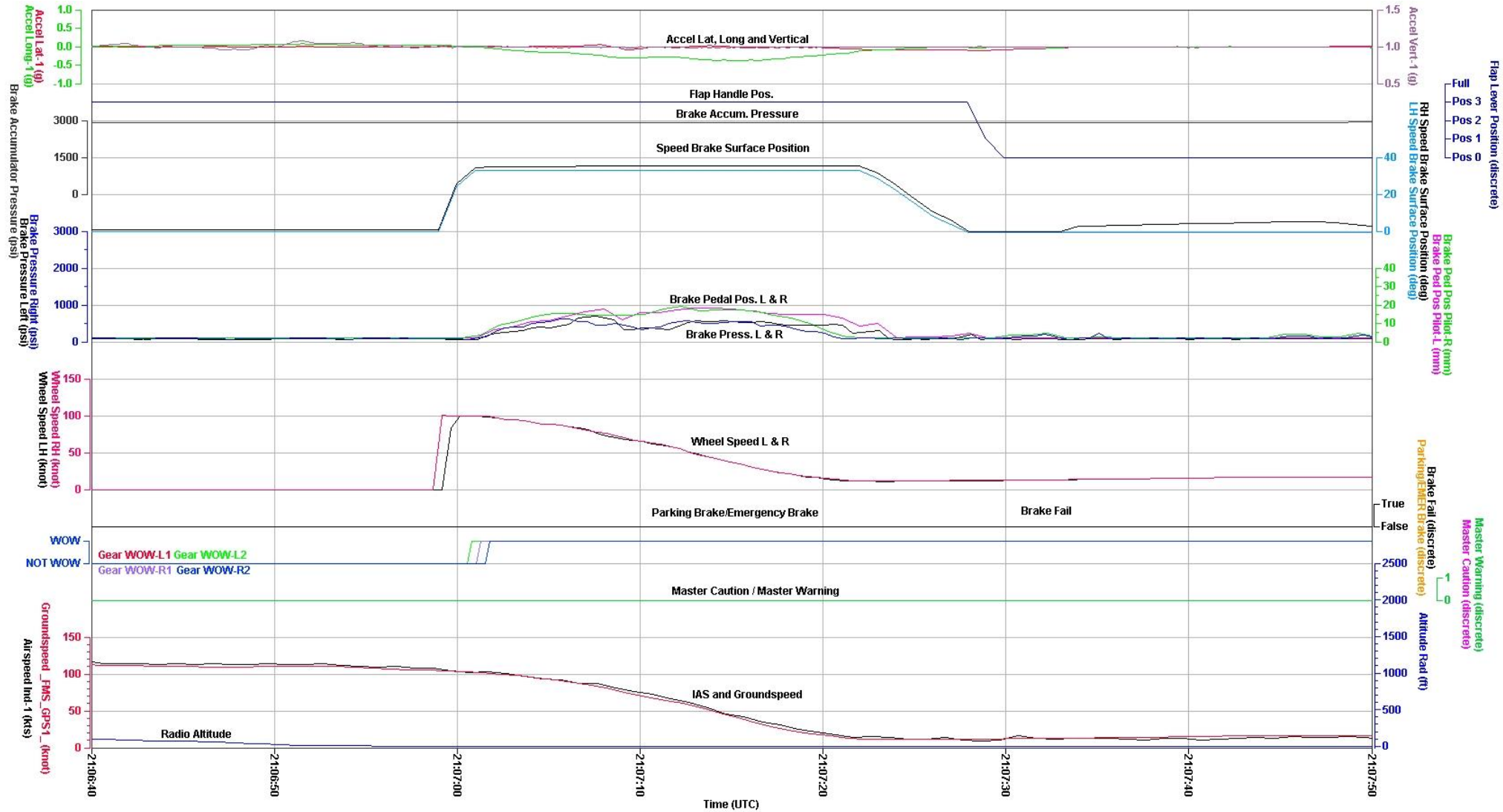


Figure 6. Plot of select performance and brake related parameters for the third previous landing.

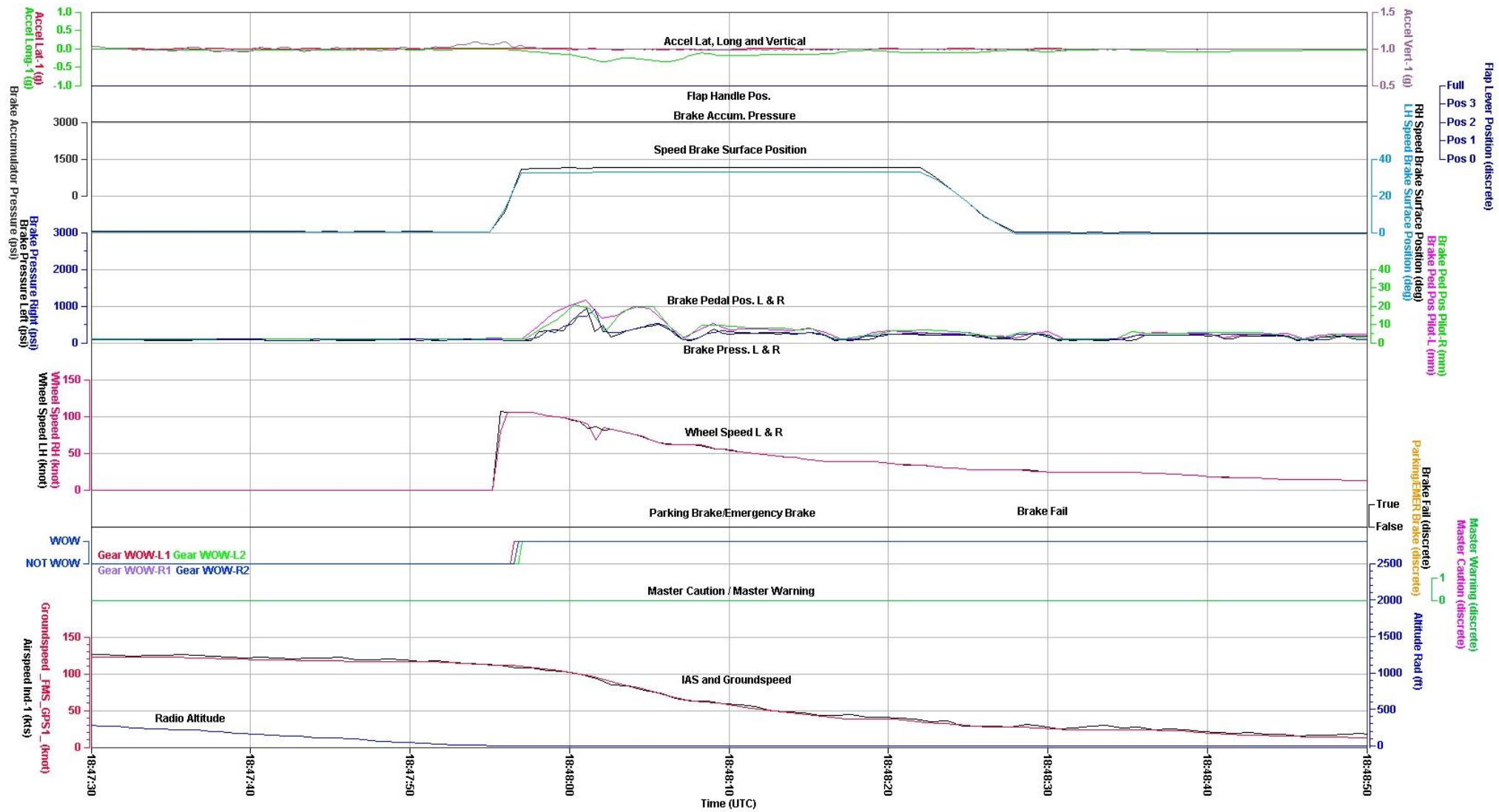
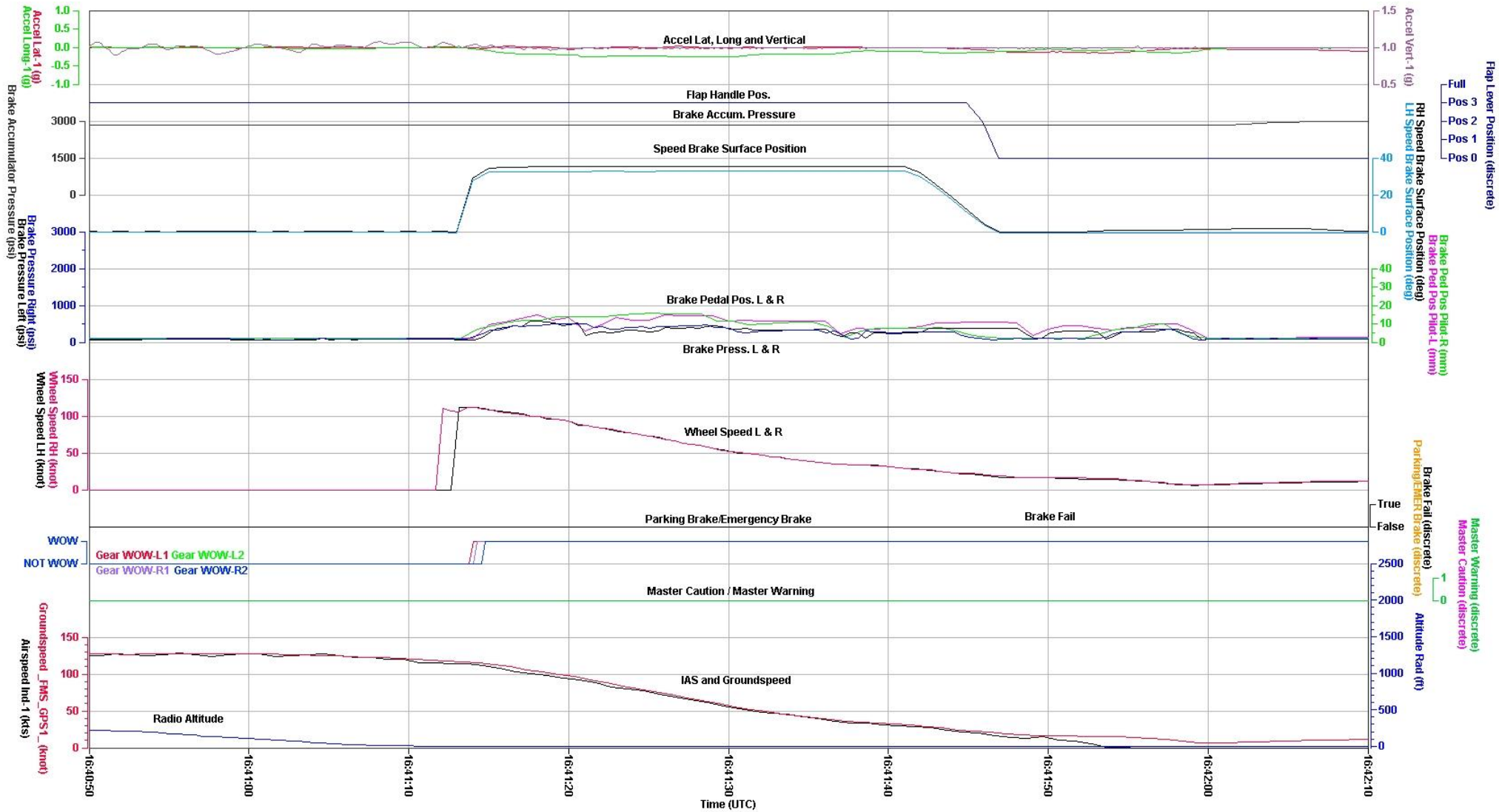


Figure 7. Plot of select performance and brake related parameters for the fourth previous landing.



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 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. Flap Lever Position	Flap Lever Position
5. Groundspeed (kts)	Groundspeed
6. Airspeed Ind-1 (kts)	Indicated Airspeed
7. Altitude Rad (ft)	Radio Altitude
8. RH Speed Brake Surface Position	Right Speed Brake Surface Position
9. LH Speed Brake Surface Position	Left Speed Brake Surface Position
10. Brake Accumulator Pressure (psi)	Brake Accumulator Pressure
11. Hydraulic Pressure System 1 (psi)	System 1 Hydraulic Pressure
12. Brake Pressure Left (psi)	Brake Pressure Left
13. Brake Pressure Right (psi)	Brake Pressure Right
14. Brake Pedal Pos. Pilot-R (mm)	Pilot Side – Brake Pedal Position – Right Pedal
15. Brake Pedal Pos. Pilot-L (mm)	Pilot Side – Brake Pedal Position – Left Pedal
16. Wheel Speed RH (knot)	Right Main Gear Wheel Speed
17. Wheel Speed LH (knot)	Right Main Gear Wheel Speed
18. Brake Fail	Brake Failure Discrete
19. Parking Brake	Parking Brake/Emergency Brake Engaged Discrete
20. Gear Hdl	Gear Handle Position
21. Gear WOW	Weight On Wheels (Left and Right Main Gear) Discrete
22. Gear WOW-L1	Left Main Gear Weight on Wheels – Sensor 1 Discrete
23. Gear WOW-L2	Left Main Gear Weight on Wheels – Sensor 2 Discrete
24. Gear WOW-R1	Right Main Gear Weight on Wheels – Sensor 1 Discrete
25. Gear WOW-R2	Right Main Gear Weight on Wheels – Sensor 2 Discrete
26. Eng 1 N1 (%)	Engine 1 – Fan Percent Speed
27. Eng 2 N1 (%)	Engine 2 – Fan Percent Speed

Table A-2. Unit and discrete abbreviations.

Units Abbreviation	Description
Deg	degrees
Knot	knots
G	g
Discrete	discrete
degC	degrees Celsius
Mm	millimeters
Ft	feet
Hrs	hours
Min	minutes

Units Abbreviation	Description
Sec	seconds
%rpm	percent revolutions per minute
psi	Pounds per square inch
true	On – Parameter Active
false	Off – Parameter Inactive

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.