

NATIONAL TRANSPORTATION SAFETY BOARD

Vehicle Recorder Division
Washington, D.C. 20594

December 5, 2013

Flight Data Recorder - 10

Specialist's Factual Report By George Haralampopoulos

1. EVENT SUMMARY

Location: Newark, New Jersey
Date: May 1, 2013
Aircraft: Embraer 145
Registration: N17560
Operator: Express Jet
NTSB Number: DCA13FA082_A

On May 1, 2013, at Newark Liberty International airport (EWR), at about 7:24 pm (EDT) an Express Jet Embraer E145, flight number 4226 was taxiing northbound on Taxiway Romeo (R) for departure to Nashville, TN (BNA) from Runway 22R and was stationary on Taxiway R between the intersections of Taxiways Mike (M) and Yankee (Y) in sequence for departure. Taxiing behind the Express Jet was a Scandinavian (SAS) Airbus A333, flight number 908, awaiting departure to Oslo, Norway (ENGM). SAS was subject to a departure flow restriction so was advised to turn right at Taxiway M and hold short of Runway 22R at Taxiway M. As SAS made the right turn onto Taxiway M the left wing struck the horizontal and vertical stabilizer of the Express Jet. The damage to the SAS airplane was minor with scratches on the winglet and the damage to the Express Jet airplane was substantial with damage to both the horizontal and vertical stabilizer. There were no reported injuries.

2. FLIGHT DATA RECORDER GROUP

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

3. FDR Carriage Requirements

The event aircraft, N17560, was manufactured in 2002 and was operating such that it was required to be equipped with an FDR that recorded, at a minimum, 57 parameters, as cited in Title 14 *Code of Federal Regulations* (CFR) Part 121.344(e).

4. DETAILS OF FLIGHT DATA RECORDER INVESTIGATION

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

Recorder Manufacturer/Model: **Honeywell 4700 256 wps**
Recorder Serial Number: **SSFDR-08762**

4.1. Honeywell 4700

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 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 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 was extracted normally using the FDR manufacturer's recommended procedures.

4.1.2. Recording Description

The FDR recording contained approximately 27 hours of data. Timing of the FDR data is measured in subframe reference number (SRN), where each SRN equals one elapsed second. The ground event was captured near the end of the recording and its duration was 18:57:40 EDT to 20:09:48 EDT. The Elevator 2 parameter evaluated for the purpose of this report did not appear to be in accordance with the federal FDR carriage requirements and was observed to be intermittent with a possibility of a bad sensor, as shown in section 4.3 of this report.

4.1.2.1. Latitude and Longitude

The resolution for the FDR Latitude and Longitude parameters is $2.7788e^{-4}$ degrees. When converted to distance, the resolution of latitude and longitude in feet are 101.27 North and about 76.79 West respectively; using a latitude of 40°41.183' N.

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 operator and 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

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, Eastern daylight time (EDT), is referenced in the 'Cockpit Voice Recorder – Factual Report'.

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 = +.

Accordingly, the time offset for the event flight data from SRN to local EDT is the following: EDT = SRN – 25380. For the rest of this report, all times are referenced as EDT, not SRN.

4.3. FDR Plots and Corresponding Tabular Data

Figures 1 to 3 contain FDR data recorded during the event on May 1, 2013. All the parameters plotted are listed in table A-1.

Figure 1 shows an overview of the event, which includes the start and shutdown of the second engine. Aircraft parameters are plotted during the event such as engine N1, attitude, ground speed, accelerations, and brake application. Elevator position 1 began to drop out intermittently starting at 1955:22 EDT and elevator position 2 was not showing any valid data. Only valid Elevator Position 1 data are included on the plot. This intermittent behavior in the elevator positions were also observed on previous flights not plotted.

Figure 2 shows a 4 minute detailed view of the event, which highlights the accelerations and brake pressure at about 1922:27 EDT that are associated with the aircraft ground incursion.

Figure 3 shows a Google Earth overlay of the aircraft's position of the recorded latitude and longitude position during the ground event. The overlay time period is from 19:00:01 EDT to 1924:29 EDT. Points shown in-between the overlay start and stop time are approximate points where the aircraft had stopped while on the taxi way.

During the event, the aircraft moved from the gate and entered the taxi way at about 1904:45 where it turned to a heading of about 39 degrees parallel to the runway. The aircraft came to rest at about 1922:02 EDT and at about 1922:26, excitation in the aircrafts acceleration can be observed.

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.

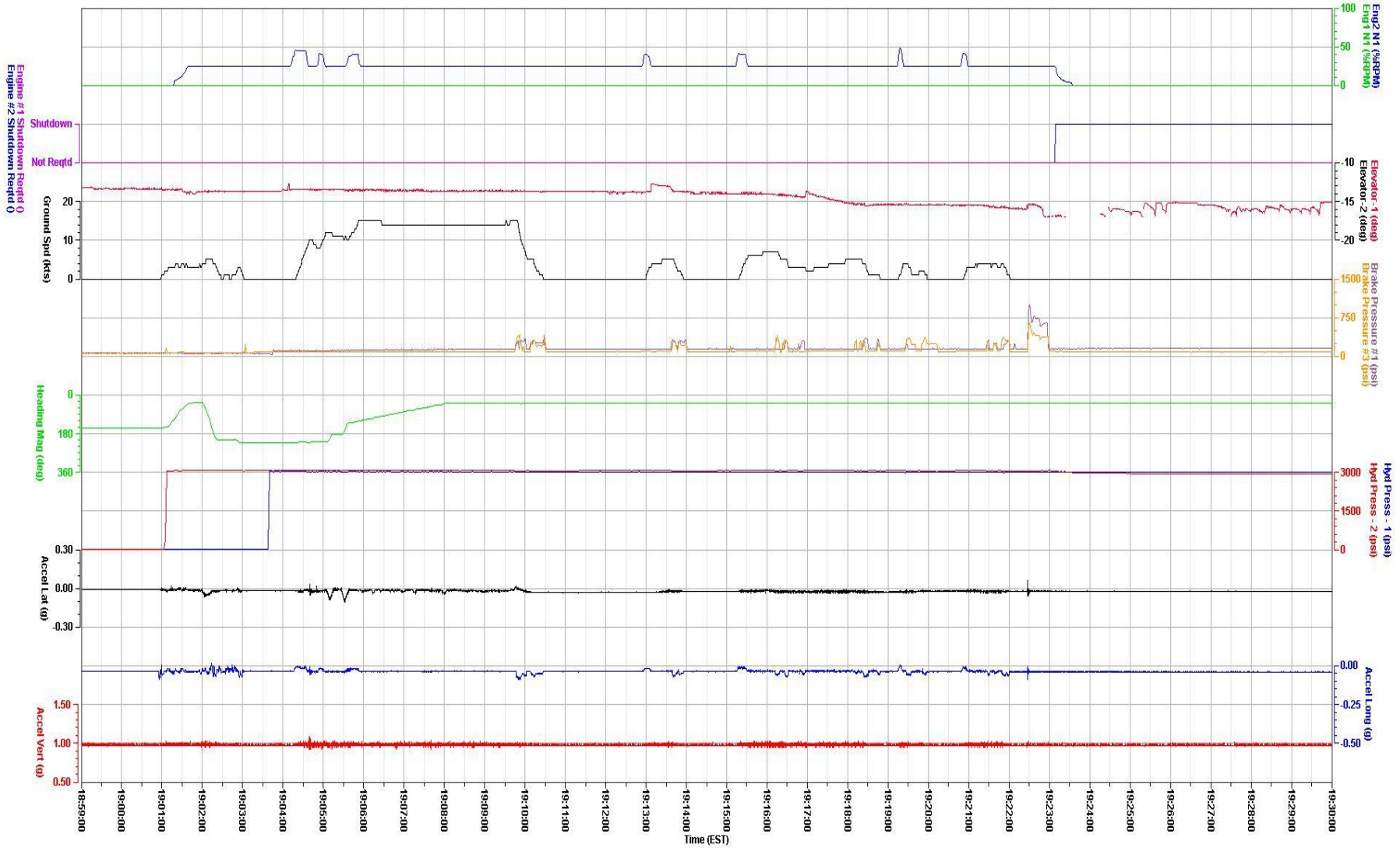
The corresponding tabular data used to create figures 1 to 3 are provided in electronic comma separated value (*.csv) format as attachment 1 to this report.

Figure 1. Plot of brake parameters during ground incursion.

Express Jet, Embraer 145, Flight 4226, N17560

Location, Date: Newark NJ, 05/01/13

NTSB No. DCA13FA082



Revised: 10 May 2013

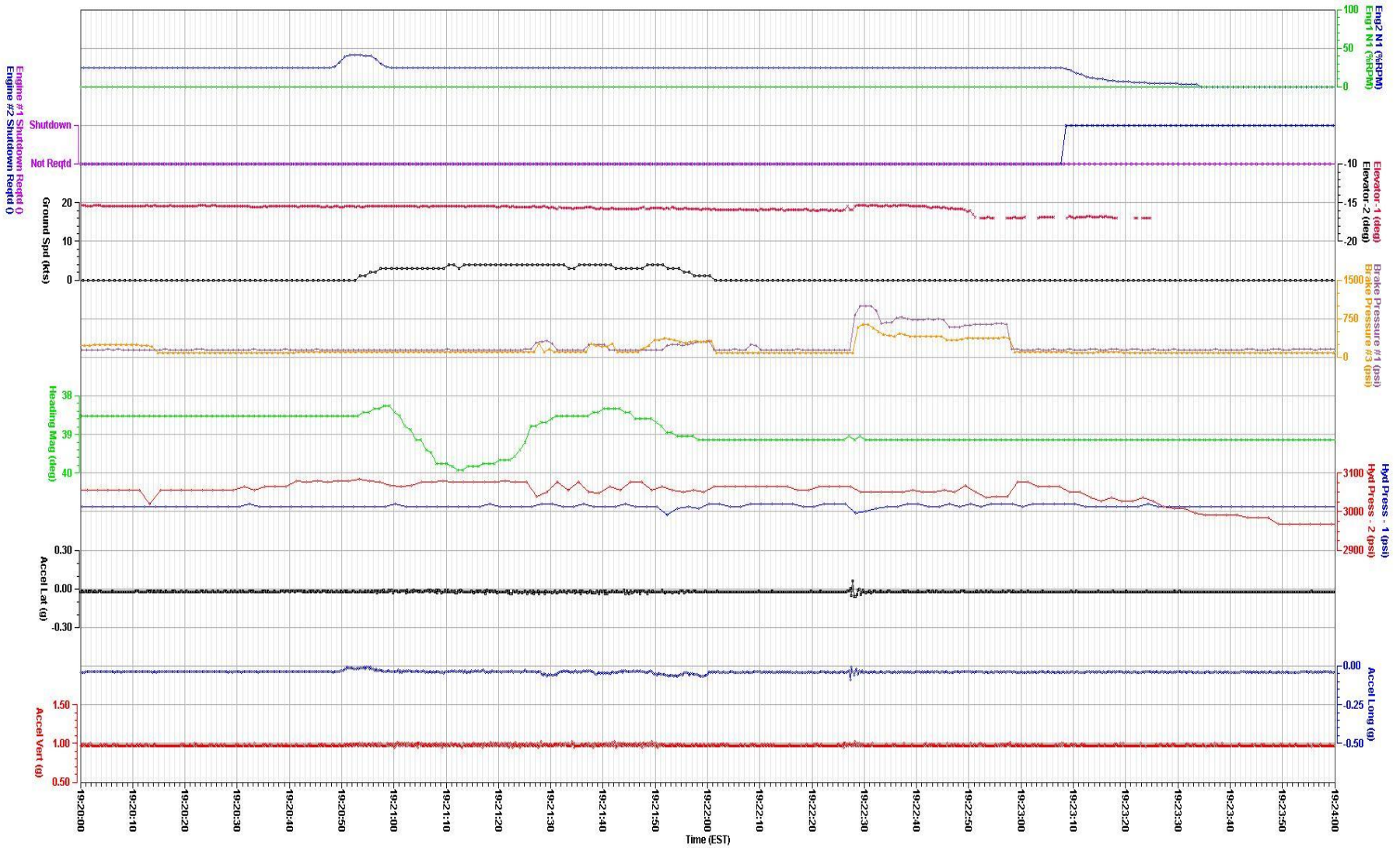
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Figure 2. Detailed plot of brake parameters during ground incursion.

Express Jet, Embraer 145, Flight 4226, N17560

Location, Date: Newark NJ, 05/01/13

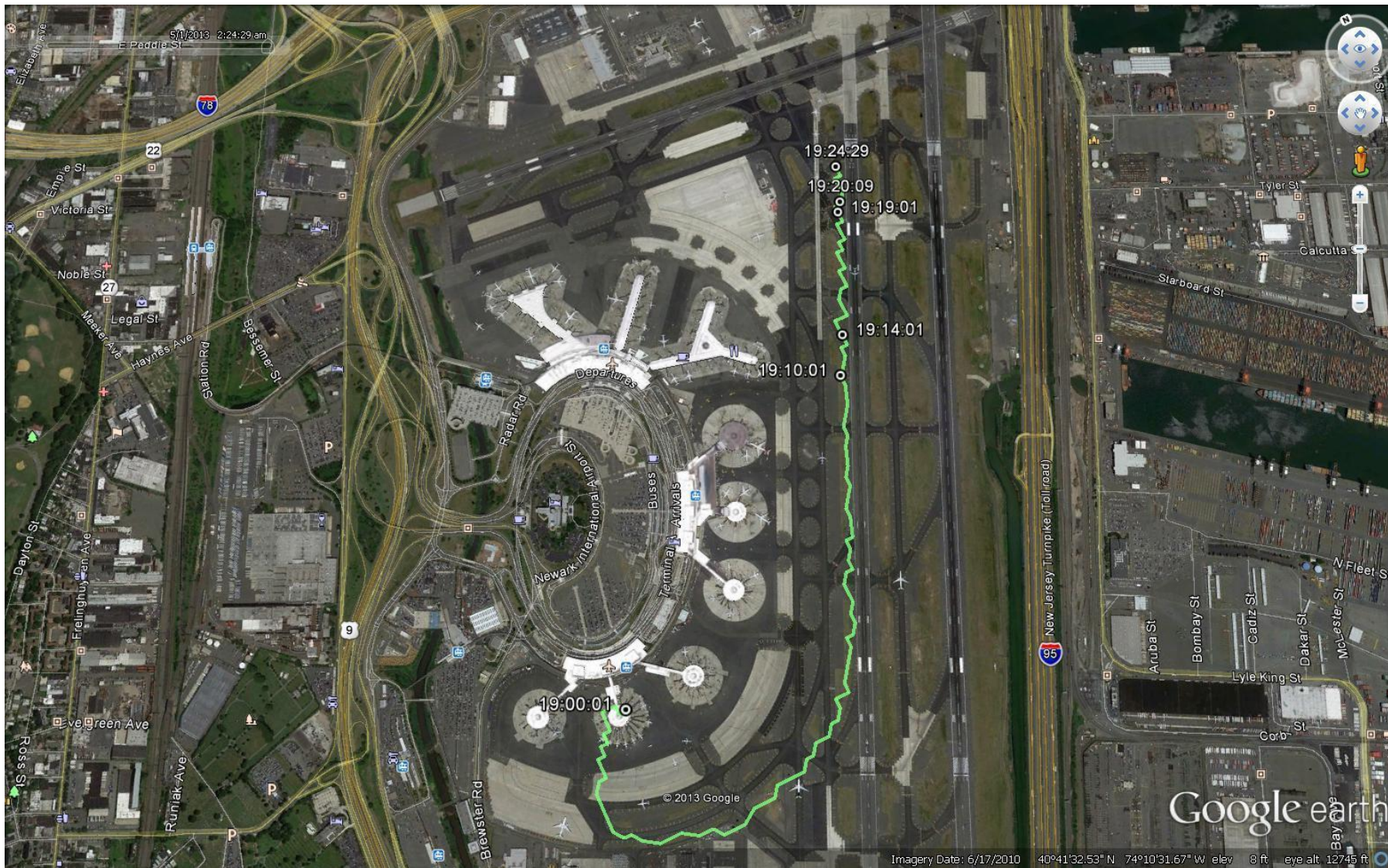
NTSB No. DCA13FA082



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Figure 3. Overlay of position during ground incursion.



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. Brake Pressure #1 (psi)	Brake Pressure Wheel 1
5. Brake Pressure #3 (psi)	Brake Pressure Wheel 3
6. Elevator-1 (deg)	Elevator 1 Position
7. Elevator-2 (deg)	Elevator 2 Position
8. Eng1 N1 (%RPM)	Engine 1 N1
9. Eng2 N1 (%RPM)	Engine 2 N1
10. Engine #1 Shutdown Reqtd (discrete)	Engine 1 Shutdown Requested
11. Engine #2 Shutdown Reqtd (discrete)	Engine 2 Shutdown Requested
12. Ground Spd (kts)	Ground Speed
13. Heading Mag – L (deg)	Magnetic Heading Left
14. Hyd Press -1 (psi)	Hydraulic Pressure 1
15. Hyd Press -2 (psi)	Hydraulic Pressure 2
16. Key VHF-1 (discrete)	Key Microphone VHF Channel 1
17. Key VHF-2 (discrete)	Key Microphone VHF Channel 2
18. Latitude – L (deg)	Left FM Latitude
19. Longitude – L (deg)	Left FM Longitude

Table A-2. Unit abbreviations.

Units Abbreviation	Description
deg	degrees
kts	knots
g	g
discrete	discrete
psi	pounds per square inch
deg/s	degree per second
%	percentage

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.