

National Transportation Safety Board

Office of Research and Engineering

Washington, DC 20594



DCA24LA295

FLIGHT DATA RECORDERS

Specialist's Factual Report

January 17, 2025

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A. ACCIDENT

Location: College Park, Georgia
Date: August 31, 2024
Time: 1947 eastern daylight time (EDT)
2347 coordinated universal time (UTC)
Airplane 1: Airbus A350-1000, Virgin Atlantic Airways¹, G-VPRD
Airplane 2: Airbus A330-323, Delta Air Lines Inc², N808NW

B. FLIGHT DATA RECORDERS SPECIALIST

Specialist: Steven Smith
Mechanical Engineer
National Transportation Safety Board (NTSB)

C. FEDERAL CARRIAGE REQUIREMENTS

Airplane 1 (Virgin):

The Virgin aircraft, G-VPRD, was operating as Title 14 *Code of Federal Regulations* (CFR) Part 129 scheduled passenger international flight. The Virgin aircraft was manufactured in 2019 and was operating such that it was required to be equipped with a flight data recorder (FDR) that recorded, at a minimum, 78 parameters, as cited in Annex 6 (Part I).

As cited in Title 14 CFR Part 129.5(b), for Non-US registered aircraft operating in the US, operators must adhere to Standards in Annex 1, Annex 6 (Part I), and Annex 8. In accordance with Annex 6 Part I §6.3.1.1.10, "All aeroplanes of a maximum certificated take-off mass of over 5700 kg for which the individual certificate of airworthiness is first issued on or after 1 January 2005 shall be equipped with an FDR which shall record at least the first 78 parameters listed in Table A8-1 of Appendix 8."

Airplane 2 (Delta):

The Delta aircraft, N808NW, was operating as Title 14 CFR 121 scheduled passenger international flight. The Delta aircraft was manufactured in 2004 and was operating such that it was required to be equipped with an FDR that recorded at a minimum, 88 parameters, as cited in CFR Part 121.344(f).

¹ Referred to as Virgin in this report.

² Referred to as Delta in this report.

D. DETAILS OF THE INVESTIGATION

An FDR group was not convened. For the Virgin aircraft (*Airplane 1*), the NTSB Vehicle Recorder Division received an electronic file containing data from the quick access recorder (QAR). For the Delta aircraft (*Airplane 2*), the NTSB Vehicle Recorder Division received an electronic file containing data from the FDR.

1.0 Data Description

An FDR records airplane flight information in a digital format using solid-state flash memory as the recording medium. FDRs receive data in the ARINC 573/717/747 configurations and are required to record a minimum of 25 hours of flight data. FDRs are configured to record a set number of 12-bit words of digital information every second. Each grouping of words is called a subframe and is identified with a subframe reference number (SRN). Each subframe has a unique 12-bit synchronization (sync) word identifying it as subframe 1, 2, 3, or 4. The sync word is the first word in each subframe. Each data parameter (for example, altitude, heading, and airspeed) has a specifically assigned word number within the subframe.

Airplane 1 (Virgin):

The QAR file was configured to record 1024 12-bit words of digital information every second.

Airplane 2 (Delta):

The FDR file was configured to record 256 12-bit words of digital information every second.

1.1 Recording Description

Airplane 1 (Virgin):

The QAR recording contained approximately 9.04 hours of data. The accident flight was the only recording, and the taxi out duration from engine 1 power up (19:31:50 EDT) to takeoff rotation (19:59:24 EDT) was 27 minutes and 34 seconds. QARs are typically used in flight data monitoring or flight operations quality assurance programs. QARs have no federal FDR carriage requirements.

Airplane 2 (Delta):

The FDR recording contained approximately 26.39 hours of data. The event flight was the last recording, and its taxi out duration from engine 1 power up (19:35:47 EDT) to takeoff rotation (19:48:57 EDT) was 13 minutes and 10 seconds. The parameters evaluated for the purpose of this report appeared to be in accordance with federal FDR carriage requirements.

1.1.1 Engineering Unit Conversions

The engineering unit 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=+).³

Table 1 lists the QAR parameters verified and provided in this report for *Airplane 1 (Virgin)*.

Table 1. Verified and provided QAR parameters for the Virgin A350-1000 aircraft.

Parameter Name (unit)	Parameter Description (unit)
Accel Lat (g)	Lateral Load Factor (unit of gravitation acceleration)
Accel Long (g)	Longitudinal Load Factor (unit of gravitation acceleration)
Accel Vert (g)	Vertical Load Factor (unit of gravitation acceleration)
Brake Press 1-12 (psi) ⁴	Brake Pressure Wheel 1-12 (pounds per square inch)
Eng1 Mstr Lvr	Engine 1 Start Switch
Eng1 N1 Act (%RPM)	Engine 1 Fan Speed (percent revolutions per minute)
Eng1 N1 Cmd (%RPM)	Engine 1 Fan Speed Command (percent revolutions per minute)
Eng1 TLA (deg)	Engine 1 Throttle Lever Angle (degrees)
Eng2 Mstr Lvr	Engine 2 Start Switch
Eng2 N1 Act (%RPM)	Engine 2 Fan Speed (percent revolutions per minute)
Eng2 N1 Cmd (%RPM)	Engine 2 Fan Speed Command (percent revolutions per minute)
Eng2 TLA (deg)	Engine 2 Throttle Lever Angle (degrees)
Gear WOW-L	Left Main Landing Gear Weight on Wheels
Gear WOW-R	Right Main Landing Gear Weight on Wheels
Ground Spd (kts)	Ground Speed (knots)
Latitude (deg)	Latitude Coordinate (degrees)
Longitude (deg)	Longitude Coordinate (degrees)
Mag Hdg (deg)	Magnetic Heading (degrees)
Park Brk	Parking Brake
Time UTC Hrs	Coordinated Universal Time Hours
Time UTC Min	Coordinated Universal Time Minutes
Time UTC Sec	Coordinated Universal Time Seconds

³ 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 = +, Right Rudder = +.

⁴ For the A350-1000, wheels 1-2, 5-6, and 9-10 are associated with the left main landing gear. Wheels 3-4, 7-8, and 11-12 are associated with the right main landing gear.

Table 2 lists the FDR parameters verified and provided in this report for *Airplane 2 (Delta)*.

Table 2. Verified and provided FDR parameters for the Delta A330-323 aircraft.

Parameter Name (unit)	Parameter Description (unit)
Accel Lat (g)	Lateral Load Factor (unit of gravitation acceleration)
Accel Long (g)	Longitudinal Load Factor (unit of gravitation acceleration)
Accel Vert (g)	Vertical Load Factor (unit of gravitation acceleration)
AT	Autothrottle Engaged
Brake Press Whl-1-8 (psi) ⁵	Brake Pressure Wheel 1-8 (pounds per square inch)
Eng1 Mstr Lvr	Engine 1 Start Switch
Eng1 N1 (%)	Engine 1 Fan Speed (percent)
Eng1 N1 Cmd (%)	Engine 1 Fan Speed Command (percent)
Eng1 TRA (deg)	Engine 1 Throttle Resolver Angle (degrees)
Eng2 Mstr Lvr	Engine 2 Start Switch
Eng2 N1 (%)	Engine 2 Fan Speed (percent)
Eng2 N1 Cmd (%)	Engine 2 Fan Speed Command (percent)
Eng2 TRA (deg)	Engine 2 Throttle Resolver Angle (degrees)
Gear WOW-L	Left Main Landing Gear Weight on Wheels
Gear WOW-R	Right Main Landing Gear Weight on Wheels
Ground Spd (kts)	Ground Speed (knots)
Latitude (deg)	Latitude Coordinate (degrees)
Longitude (deg)	Longitude Coordinate (degrees)
Mag Hdg (deg)	Magnetic Heading (degrees)
Parking Brake	Parking Brake
Time UTC Hrs	Coordinated Universal Time Hours
Time UTC Min	Coordinated Universal Time Minutes
Time UTC Sec	Coordinated Universal Time Seconds

1.2 Time Correlation

Airplane 1 (Virgin):

Correlation of the QAR data to local time, EDT, was established by using the recorded UTC Hours, UTC Minutes, and UTC Seconds and then applying an additional 4 hours offset to change UTC to EDT. The offset is provided in table 3.

⁵ For the A330-323, wheels 1-2 and 5-6 are associated with the left main landing gear. Wheels 3-4 and 7-8 are associated with the right main landing gear.

Airplane 2 (Delta):

Correlation of the FDR data to the event local time, EDT, was established by using the recorded UTC Hours, UTC Minutes, and UTC Seconds and then applying an additional 4 hours offset to change UTC to EDT. The offset is provided in table 3.

Table 3. Recorder time offset.

Airplane	SRN to EDT offset
1	66,909 seconds
2	9,016 seconds

For the remainder of this report, all times are referenced as EDT.

1.3 Latitude/Longitude Resolution

The latitude and longitude parameters for both aircraft are 20 bits and 21 bits, respectively. At Hartfield-Jackson Atlanta International Airport (KATL), the latitude parameter has a resolution of about 63 ft and the longitude parameter has a resolution of about 52 ft. Therefore, the Google Earth overlay presented in Section E will utilize higher precision Automatic Dependent Surveillance- Broadcast (ADS-B) latitude and longitude.

1.4 Non-Computed Data Pattern

Some parameters record a non-computed data (NCD) pattern. An NCD pattern is indicative that the raw data is no longer reliable or not available. An NCD pattern is typically recorded when the aircraft is on the ground. When the engines were not running, both the Delta and Virgin aircraft engine 1 and 2 N1 actual and commands recorded NCD patterns.

E. FIGURES AND TABULAR DATA

Figures 1 to 5 contain recorded data during the event on August 31, 2024. All the parameters listed in tables 1 and 2 are plotted except UTC Hours, UTC Minutes, and UTC Seconds.

Figures 1 and 2 are time history plots of the Virgin (Airplane 1) A350-1000 aircraft taxi to runway 27R and braking parameters, respectively. Figures 3 and 4 are time history plots of the Delta (Airplane 2) A330-323 aircraft taxi through takeoff rotation and braking parameters, respectively. Figure 5 is an overlay of ADS-B data for both aircraft taxiing to runway 27R. The weather and lighting conditions in Google Earth are not necessarily representative of the weather and lighting conditions present at the time of the recording. Figure 6 is the Jeppesen airport diagram for KATL.

The recorded data indicated the following sequence of events:

- **19:31:50 EDT:** The Virgin aircraft engine 1 master lever was on.
- **19:35:47 EDT:** The Delta aircraft engine 1 master lever was on.
- **19:37:16 EDT:** The Delta aircraft engine 2 master lever was on.
- **19:37:57 EDT:** The Virgin aircraft began to be pushed back from the gate at RAMP 8.
- **19:40:57 EDT:** The Delta aircraft began to taxi from RAMP 5 to taxiway L7.
- **19:42:13 EDT:** The Delta aircraft began to turn left onto taxiway L.
- **19:42:37 EDT:** The Virgin aircraft began to taxi via taxiway J at RAMP 8.
- **19:42:48 EDT:** The Delta aircraft ground speed reduced to 10 kts. The Delta aircraft position was approximately 230 ft short of taxiway L10.
- **19:43:10 EDT:** The Virgin aircraft began to turn left onto taxiway L.
- **19:44:26 EDT:** The Virgin aircraft engine 2 master lever was on.
- **19:46:50 EDT:** The Virgin aircraft passed the turn for taxiway LC. The ground speed was 8 kts. Over the next 19 seconds, the ground speed fluctuated between 6 kts and 8 kts.
- **19:47:09 EDT:** The Virgin aircraft passed the turn for taxiway LB. The ground speed was 8 kts and began to reduce.
- **19:47:15 EDT:** The Delta aircraft began to make a right turn on taxiway LC. The ground speed was 9 kts. The ground speed remained constant.
- **19:47:19 EDT:** The Delta aircraft ground speed was 10 kts for 5 seconds.
- **19:47:24 EDT:** The Delta aircraft ground speed began to reduce. The magnetic heading was 130 deg and increasing.
- **19:47:26 EDT:** The Virgin aircraft was between taxiway LB and LA. The ground speed was 0 kts.
- **19:47:36 EDT:** The Delta aircraft ground speed was 7 kts and began to increase. The magnetic heading was 175 deg and was increasing.
- **19:47:57 EDT:** The Virgin aircraft began to make a right turn onto taxiway LA. The Delta aircraft began to make a right turn onto runway 27R.
- **19:48:14 EDT:** The Delta aircraft throttle resolver angles increased, consistent with takeoff roll.
- **19:48:51 EDT:** The Virgin aircraft ground speed was 0 kts and was located at the hold short line for runway 27R.

- **19:48:57 EDT:** The Delta aircraft main gear WOW changed from 'GND' to 'AIR', consistent with takeoff rotation.
- **19:58:33 EDT:** The Virgin aircraft throttle lever angles increased, consistent with takeoff roll.
- **19:59:24 EDT:** The Virgin aircraft main gear WOW changed from 'GND' to 'AIR', consistent with takeoff rotation.

The corresponding tabular data used to create figures 1 and 2 are provided in electronic comma-separated value (CSV) format as attachment 1 to this report.

The corresponding tabular data used to create figures 3 and 4 are provided in CSV format as attachment 2 to this report.

The corresponding tabular data used to create figure 5 is provided in CSV format as attachment 3 to this report.

Submitted by:

Steven Smith
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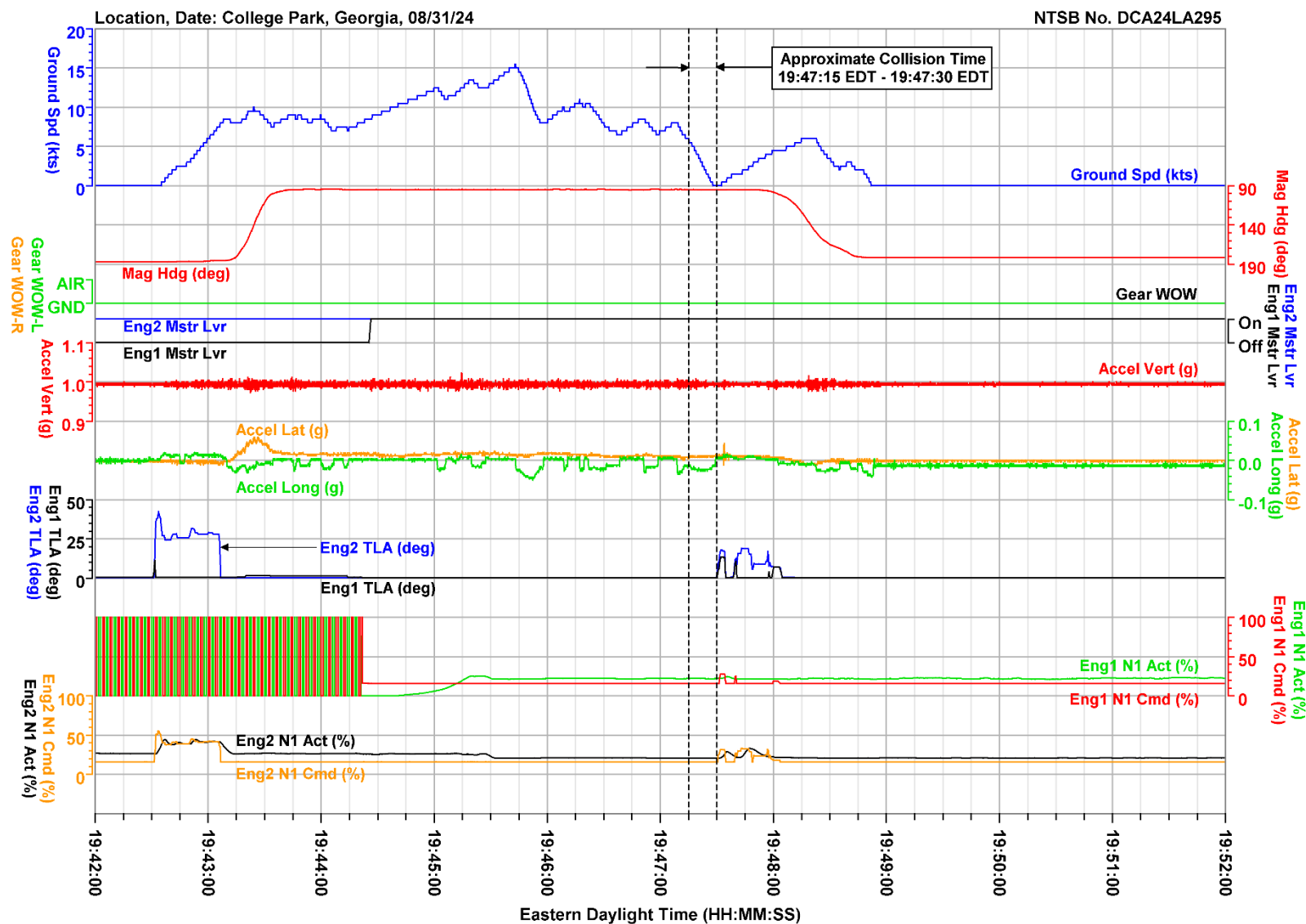


Figure 1. Time history plot of the taxi to runway 27R for the Virgin (Airplane 1) A350-1000 aircraft.

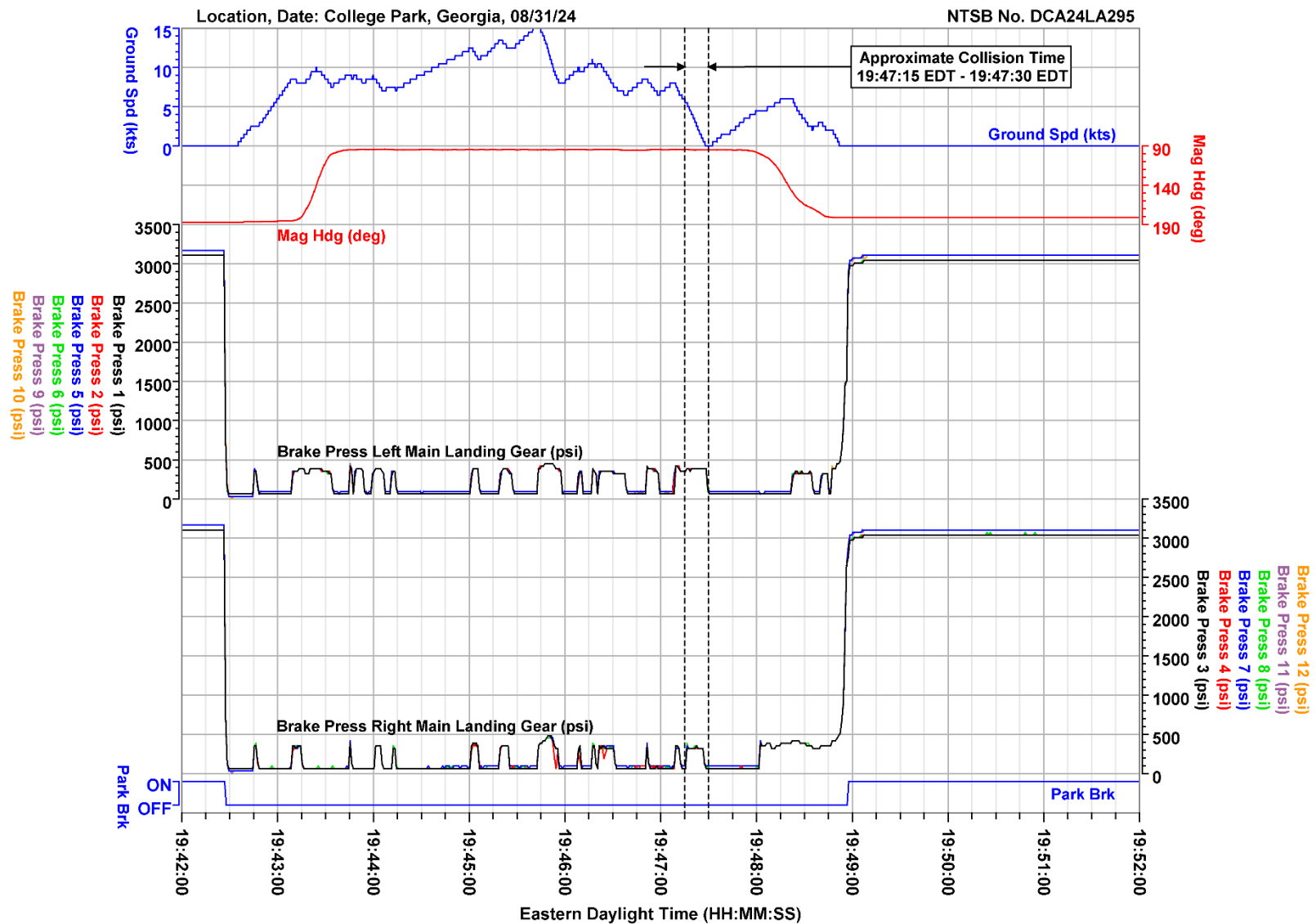


Figure 2. Time history plot of braking parameters for the Virgin (Airplane 1) A350-1000 aircraft.

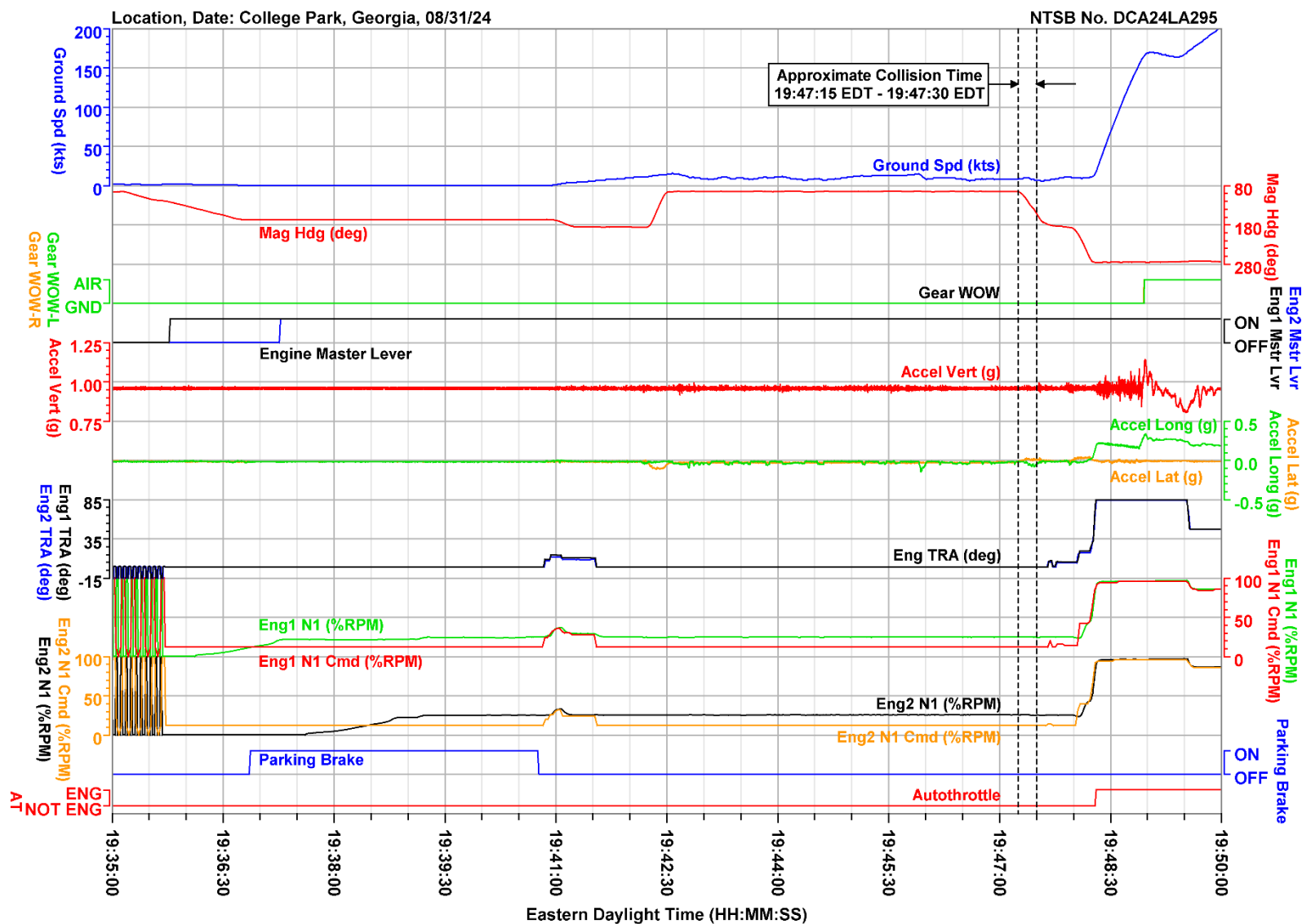


Figure 3. Time history plot of taxi through takeoff rotation for the Delta (Airplane 2) A330-323 aircraft.

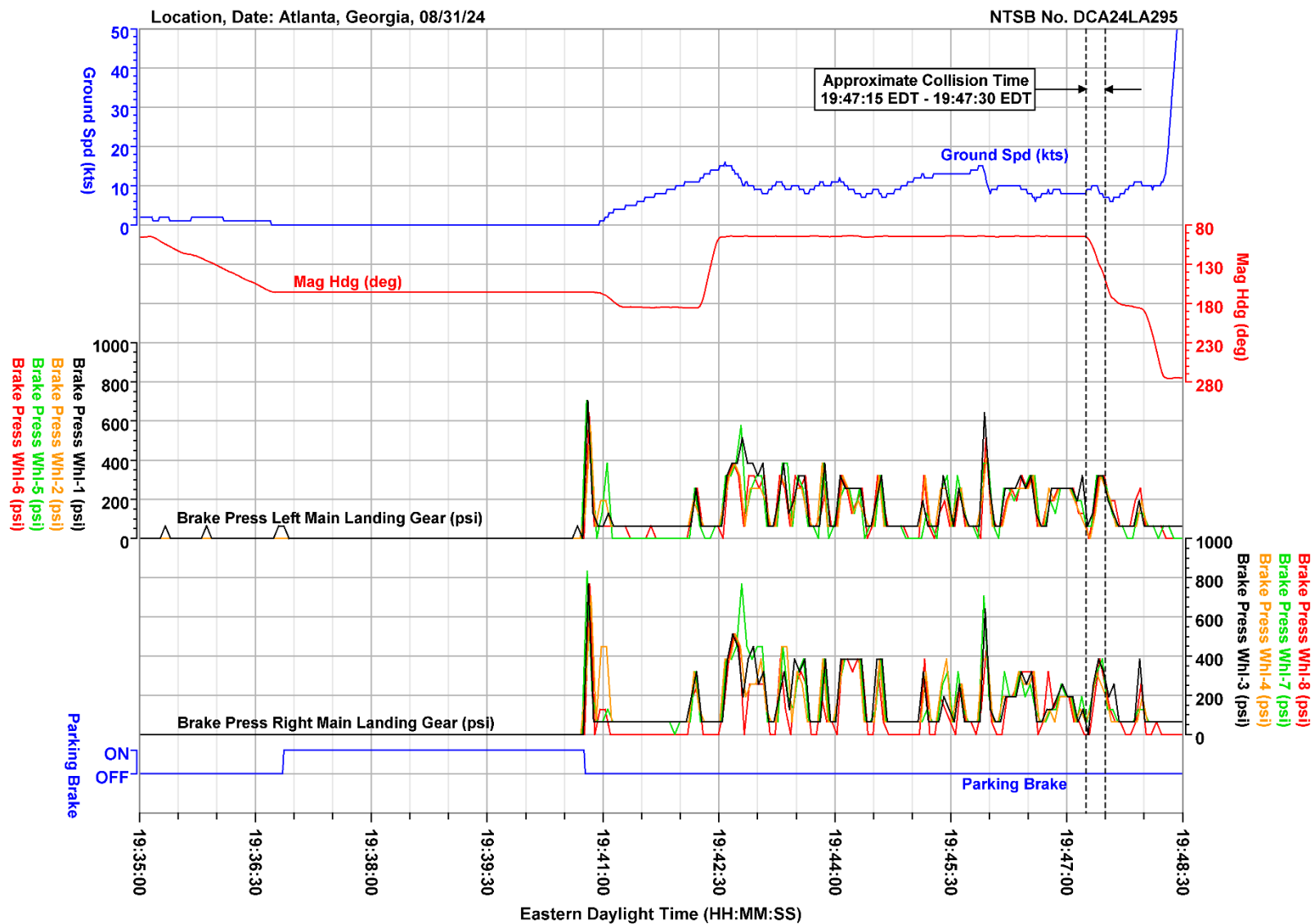


Figure 4. Time history plot of braking parameters for the Delta (Airplane 2) A330-323 aircraft.



Figure 5. Google Earth overlay of the taxi for both aircraft to runway 27R using ADS-B data. The red box represents approximate location where the wingtip of Airplane 2 (Delta) struck the horizontal stabilizer of Airplane 1 (Virgin).

