NATIONAL TRANSPORTATION SAFETY BOARD
Vehicle Recorder Division

June 9, 2021

Flight Data Recorder

Specialist's Factual Report
By Kyle Garner

1. EVENT

Location:	San Diego, CA
Date:	February 13, 2021
Aircraft:	Dassault Falcon 900EX
Registration:	N823RC
Operator:	Aerospike Iron Aero, LLC
NTSB Number:	WPR21LA110

2. FLIGHT DATA RECORDER GROUP

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

3. FDR CARRIAGE REQUIREMENTS

The event aircraft, N823RC, was manufactured in 2008 and was operating such that it was required to be equipped with an FDR that recorded, at a minimum, 17 parameters, as cited Title 14 *Code of Federal Regulations* Part 91.609c Appendix E.

4. DETAILS OF INVESTIGATION

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

Recorder Manufacturer/Model:	**Honeywell ARFDR, 256 wps**
Recorder Serial Number:	**ARFDR-00662**

4.1. Honeywell ARFDR Description

The Honeywell ARFDR is a lightweight 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 717 configurations and can record a minimum of 25 hours of flight data.

The ARFDR was 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 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 (for example, altitude, heading, and airspeed) has a specifically assigned word number within the subframe. The SSFDR is designed to meet the crash-survivability requirements of TSO-C124a.

4.1.1. Recorder Condition

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

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 event flight was the last flight of the recording.

The parameters evaluated for this report appeared to be per federal FDR carriage requirements, except for vertical acceleration which was not valid for the entirety of the recording.

4.1.3. 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=+).[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.

4.1.4. 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 the electronic data has not been corrected for the local altimeter setting at the time of the event.

4.2. Time Correlation

Correlation of the FDR data from SRN to Coordinated Universal Time (UTC), was established by using the recorded GPS Hours, GPS Minutes, and GPS Seconds parameters. Then, conversion from UTC to Pacific standard time (PST) was established by subtracting eight hours.

Accordingly, the time offset for the event flight data from SRN to UTC is the following:

PST = SRN - 55503

Therefore, for the rest of this report, all times are referenced as PST.

4.3. FDR Plots and Corresponding Tabular Data

Figures 1 to 4 contain FDR data recorded during the event on February 13, 2021. All the parameters listed in Table A-1 are plotted or provided in tabular format. Data are only plotted for one minute and five seconds surrounding the landing event from 1146:10 to 1147:15 PST.

[1] CRT=+ means that for parameters recorded that indicate 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 = +. The only exception to this convention is that positive left aileron will be indicative of a left turn/roll.

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.

Figure 1 is a plot of basic parameters for the event flight's takeoff roll including longitudinal and lateral acceleration, pressure altitude, landing gear status, magnetic heading, engine N1, and air and ground speed.

Figure 2 is a plot of braking parameters for the event flight's takeoff roll. Longitudinal and lateral acceleration, air and ground speed, and engine 1/2/3 N1 are also shown for reference.

Figure 3 is a plot of engine parameters for the event flight's takeoff roll. Air and ground speed are also shown for reference.

Figure 4 is a plot of pitch-related parameters for the event flight's takeoff roll. Air and ground speed and engine 1/2/3 N1 are also shown for reference.

The corresponding tabular data used to create Figures 1 to 4 are provided in compressed electronic comma-separated value (*.csv) format as attachment 1 to this report.

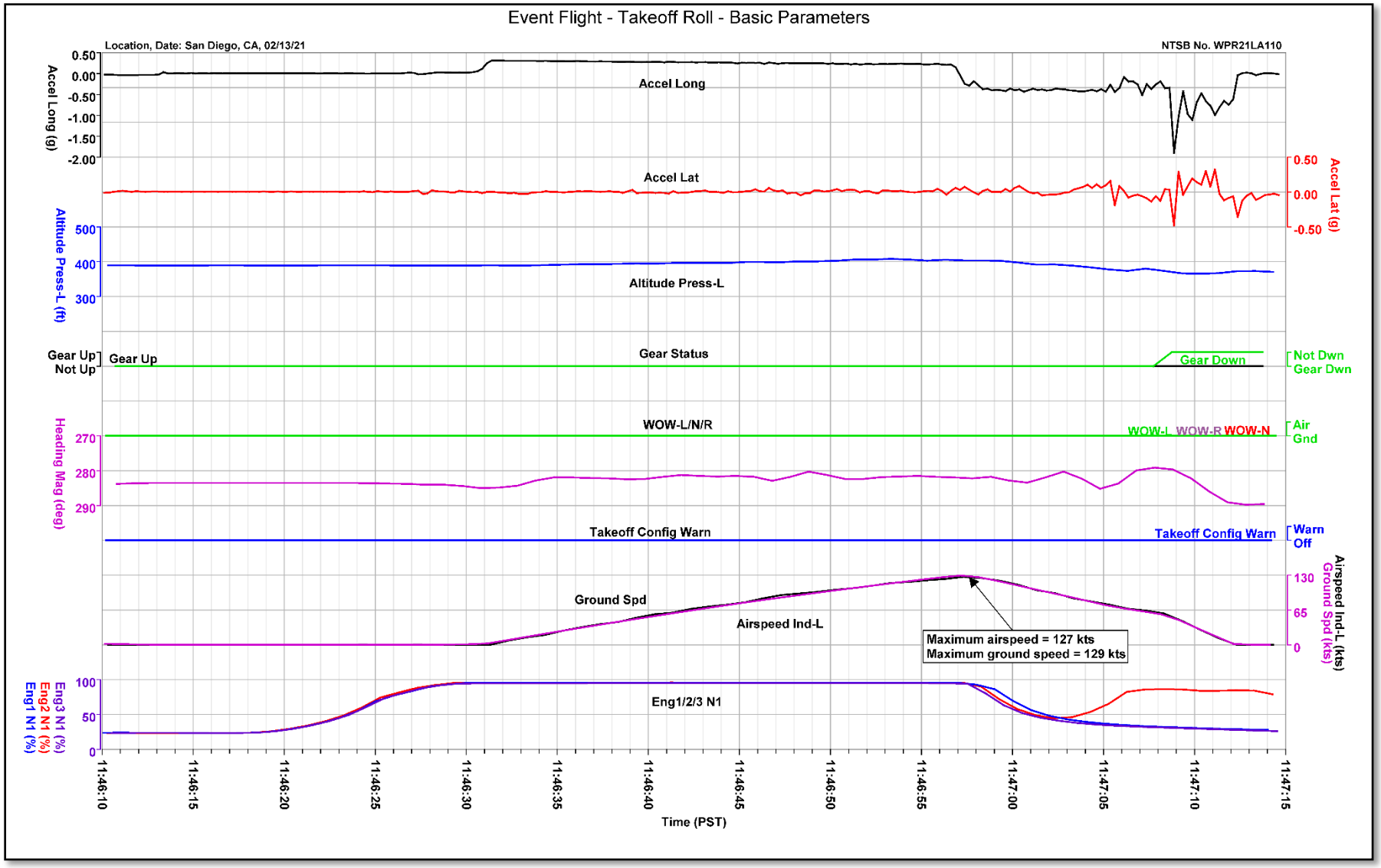

Figure 1. Basic parameters during takeoff roll event.

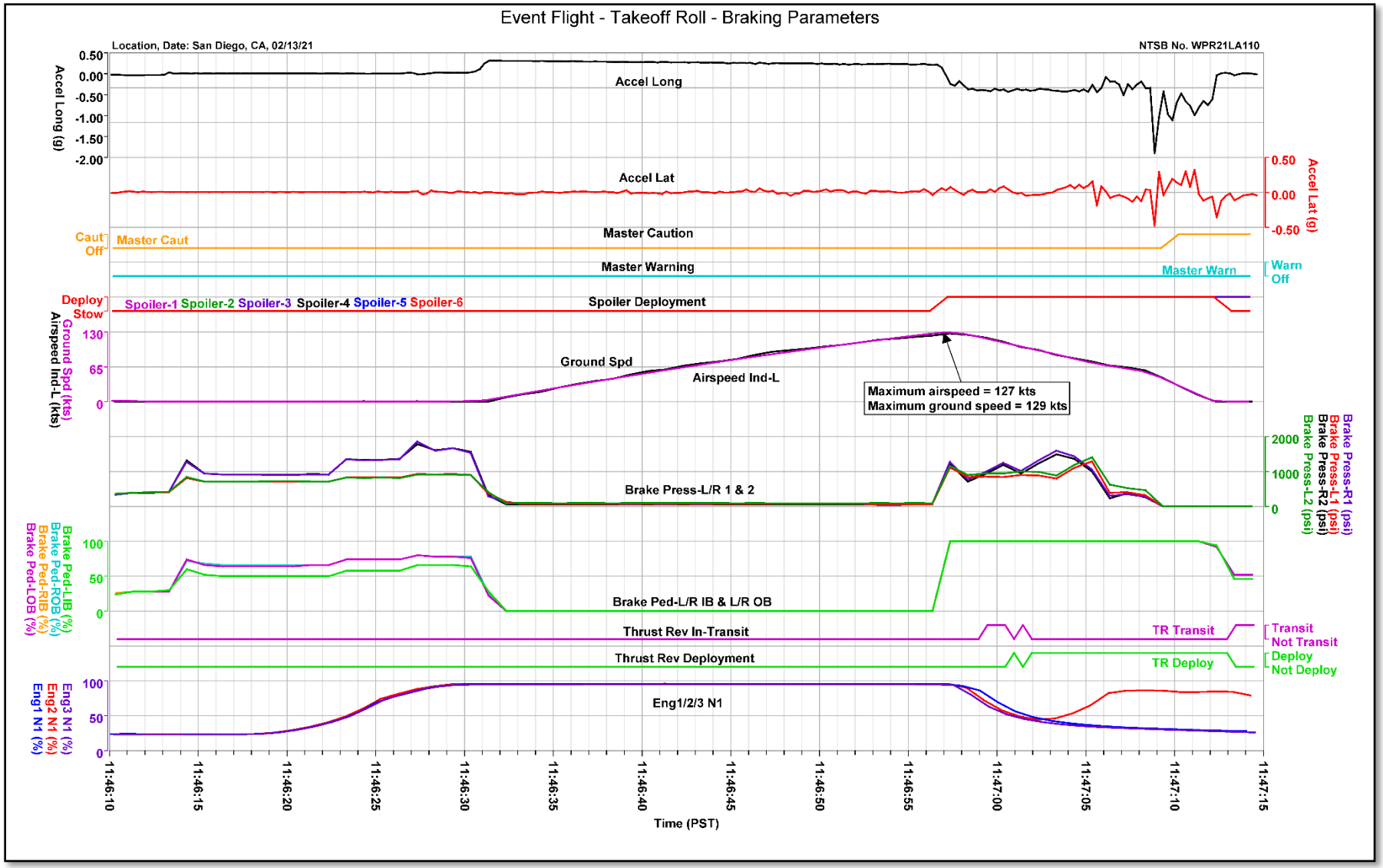

Figure 2. Braking parameters during takeoff roll event.

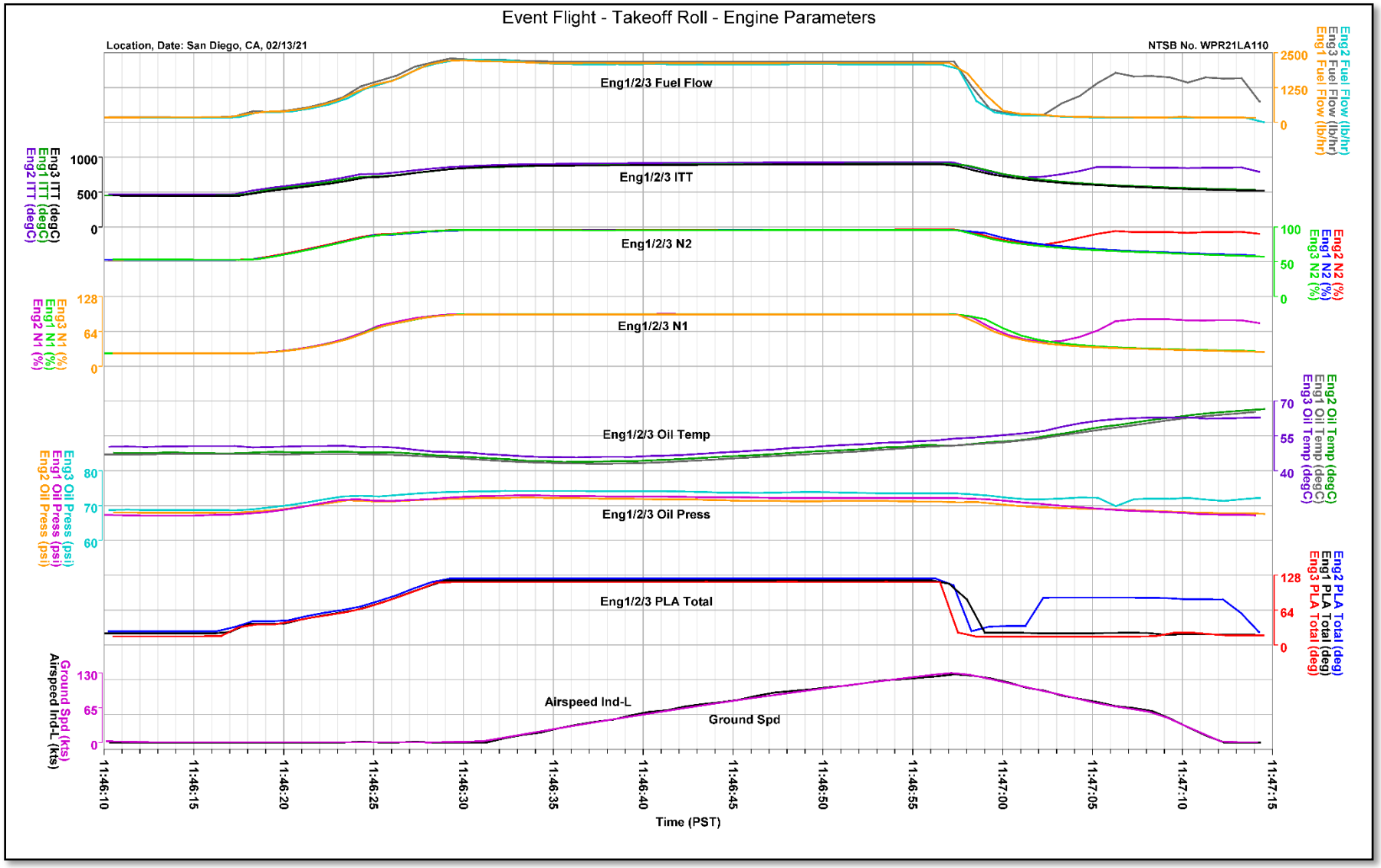

Figure 3. Engine parameters during takeoff roll event.

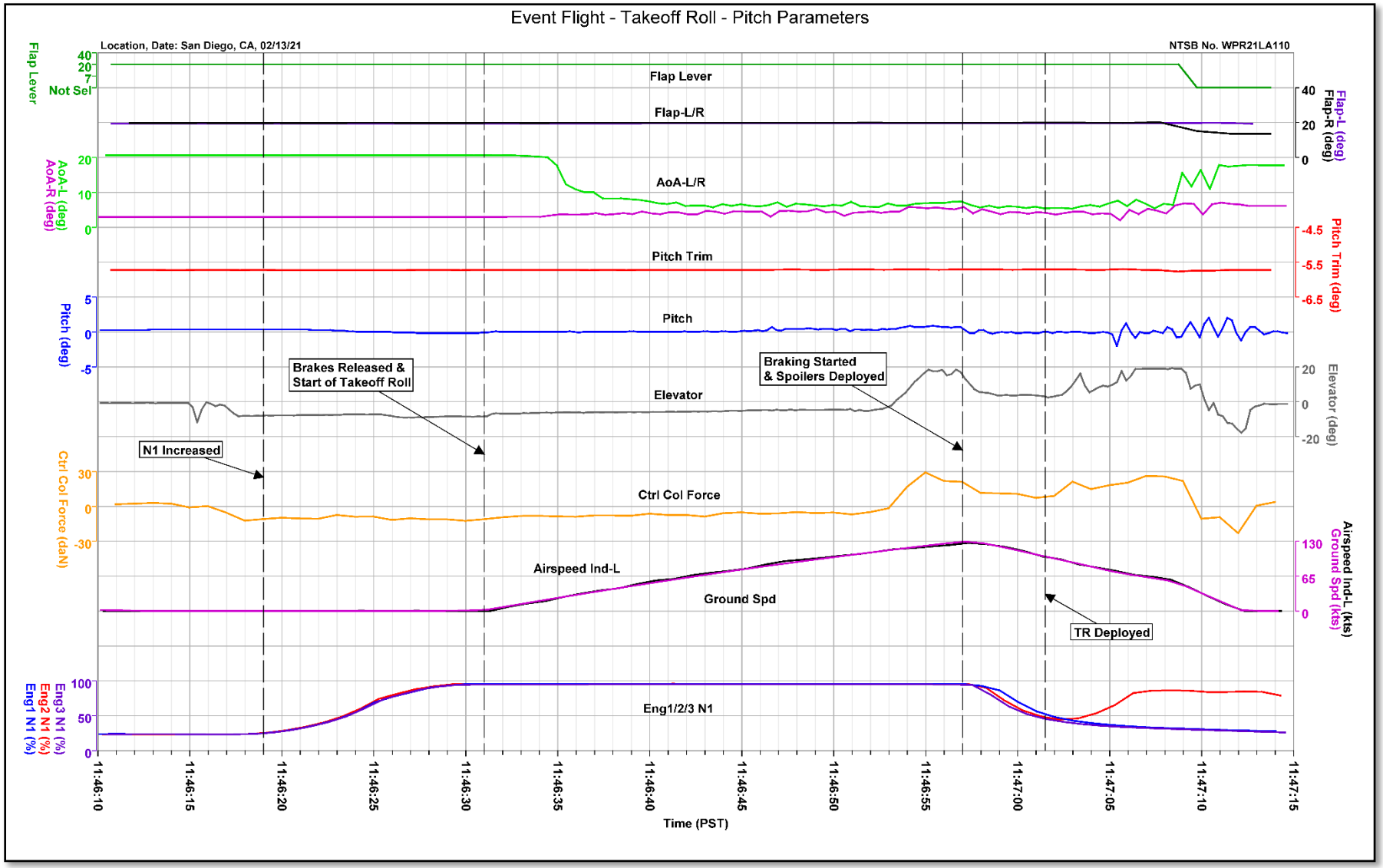

Figure 4. Pitch parameters during takeoff roll event.

APPENDIX A

This appendix describes the parameters provided and verified in this report. Table A-1 lists the plot/table labels, parameter names, and units. Additionally, Table A-2 describes the unit and discrete abbreviations used in this report.

Table A-1. Verified and provided FDR parameters.

Plot/Table Labels	Parameter Names	Units
Accel Lat	Lateral Acceleration	g
Accel Long	Longitudinal Acceleration	g
Airspeed Ind-L	Indicated Airspeed Left	kts
Altitude Press-L	Pressure Altitude Left	ft
AoA-L/R	Angle of Attack-Left/Right	deg
AP Eng	Auto-Pilot Engaged	
AP Lat Mode-L	Autopilot Active Lateral Mode-L	
AP Vert Mode-L	Autopilot Active Vertical Mode-L	
AT Eng	Autothrottle Engaged	
AT Mode	Autothrottle Mode	
Baro Sel-L1	Baro Select-L ADS1	mb
Baro Sel-L2	Baro Select-L ADS2	mb
Baro Sel-R1	Baro Select-R ADS1	mb
Baro Sel-R2	Baro Select-R ADS2	mb
Brake Ped-LIB	Brake Pedal Position LH MAU1	%
Brake Ped-LOB	Brake Pedal Position RH MAU1	%
Brake Ped-RIB	Brake Pedal Position RH MAU2	%
Brake Ped-ROB	Brake Pedal Position LH MAU2	%
Brake Press-L1	Brake Pressure Left Circuit 1	psi
Brake Press-L2	Brake Pressure Left Circuit 2	psi
Brake Press-R1	Brake Pressure Right Circuit 1	psi
Brake Press-R2	Brake Pressure Right Circuit 2	psi
Ctrl Col Force	Control Column Force	daN
Elevator	Elevator Position	deg
Eng1/2/3 Fuel Flow	Engine 1/2/3 Fuel Flow	lb/hr
Eng1/2/3 ITT	Engine 1/2/3 Interstage Turbine Temperature	degC
Eng1/2/3 N1	Engine 1/2/3 N1	%
Eng1/2/3 N1 Tgt	Thrust Target Eng.1/2/3 N1 PLA	%
Eng1/2/3 N2	Engine 1/2/3 N2	%
Eng1/2/3 Oil Press	Engine 1/2/3 Oil Pressure	psi
Eng1/2/3 Oil Temp	Engine 1/2/3 Oil Temperature	degC
Eng1/2/3 PLA Total	Engine 1/2/3 Power Lever Angle Total	deg
Flap Lever	Flap Cockpit Control Select	
Flap-L/R	Flap Position-Left/Right	deg
Fuel Qty-C/L/R	Fuel Quantity Center/Left Wing/Right Wing	lb
Ground Spd	Ground Speed	kts
Heading Mag	Magnetic Heading	deg
Heading True	True Heading	deg
Hyd Press-1/2	Hydraulic Pressure-1/2	psi

APPENDIX A

Plot/Table Labels	Parameter Names	Units
Key VHF-1/2	VHF Keying Pilot/Copilot	
Latitude	Latitude	deg
Longitude	Longitude	deg
Master Caut	Master Caution	
Master Warn	Master Warning	
Pitch	Pitch	deg
Pitch Trim	Pitch Trim	deg
Roll	Roll	deg
Rudder	Rudder Position	deg
Select Alt	Selected Altitude	ft
Select Crs	Selected Course	deg
Select Hdg	Selected Heading	deg
Select Hdg-Trk	Selected Heading or Track	
Select Mach FMS	Selected Mach FMS	
Select Mach Man	Selected Mach Manual	
Select Spd FMS	Selected Speed FMS	kts
Select Spd IAS-Mach	Selected Speed IAS or Mach	
Select Spd Man	Selected Speed Manual	
Select Spd Man-FMS	Selected Speed Manual or FMS	
Select Trk	Selected Track	deg
Select Vert Spd	Selected Vertical Speed	ft/sec
Slat Transit	Leading Edge Flap Moving	
Slat-LIB	Leading Edge Flap Position-LIB	
Slat-LOB	Leading Edge Flap Position-LOB	
Slat-RIB	Leading Edge Flap Position-RIB	
Slat-ROB	Leading Edge Flap Position-ROB	
Spoiler-1	Ground Spoiler Outboard LH	
Spoiler-2	Ground Spoiler Median LH	
Spoiler-3	Ground Spoiler Inboard LH	
Spoiler-4	Ground Spoiler Inboard RH	
Spoiler-5	Ground Spoiler Median RH	
Spoiler-6	Ground Spoiler Outboard RH	
Takeoff Config Warn	No Take Off	
TAT-L/R	Total Air Temperature-ADC1/2	degC
TR Arm	Thrust Reverser Position-Armed	
TR Deploy	Thrust Reverser Position-Deployed	
TR Transit	Thrust Reverser Position-In-Transit	
Wind Direction	Wind Direction	deg
Wind Spd	Wind Speed	kts
WOW-L/N/R	Air/Ground-Left/Nose/Right	

NOTE: Parameters with a blank unit description in Table A-1 are discretes. 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.

APPENDIX A

Table A-2. Unit abbreviations.

Unit and discrete abbreviations	Descriptions
%rpm	percent revolutions per minute
daN	dekanewton
deg	degrees
degC	degrees Celsius
ft	feet
ft/sec	feet per second
kts	knots
lb	pounds
lb/hr	pounds per hour
mb	millibars
psi	pounds per square inch
sec	seconds