

National Transportation Safety Board

Office of Research and Engineering

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CEN22LA209

FLIGHT DATA RECORDER

Specialist's Factual Report

March 4, 2024

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A. ACCIDENT

Location: Fort Stockton, Texas
Date: May 21, 2022
Time: About 1630 central daylight time (CDT)
Airplane: Beechcraft Super King Air 300C, Textron Aviation, N98FM

B. FLIGHT DATA RECORDER SPECIALIST

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C. FEDERAL CARRIAGE REQUIREMENTS

The accident airplane, N98FM, was operating as an engineering test flight under the provisions of Title 14 *Code of Federal Regulations (CFR)* Part 91. The airplane was configured and operated such that it was not required to be equipped with a flight data recorder (FDR).

Although it was not required by statute to be equipped with a FDR, the airplane had a cockpit voice and data recorder (CVDR)¹ installed and operational at the time of the accident.

D. DETAILS OF THE INVESTIGATION

The NTSB Vehicle Recorder Division received the following cockpit voice and data recorder (CVDR):

Recorder Manufacturer/Model: L3 Harris FA2300 CVDR
Part Number: 2312-8500-02
Recorder Serial Number: 2051092

The airplane also had supplemental instrumentation to support the flight test program, which included parameters that were not recorded on the CVDR. The operator provided a Microsoft Excel spreadsheet (.XLSX format) of parameters recorded by the flight test instrumentation on the day of the accident flight.

¹ A CVDR is a combined cockpit voice recorder and flight data recorder. However, per the recorder manufacturer, the voice recording functionality of this CVDR was disabled by request from the airplane manufacturer/operator.

1.0 FA2300 CVDR Description

The L3 Harris FA2300 CVDR records airplane flight information in a digital format using solid-state flash memory as the recording medium. The CVDR 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 512 12-bit words of digital information every second. Each grouping of 512 words 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 512-word intervals. Each data parameter (for example, altitude, heading, and airspeed) has a specifically assigned word number within the subframe. The CVDR is designed to meet the crash-survivability requirements of TSO-C123a.

1.1 CVDR Recorder Condition

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

1.2 CVDR Recording Description

The CVDR recording contained approximately 92 hours of data. Timing of the 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 12 minutes.

2.0 Flight Test Data Description

The .XLSX file of flight test parameters contained approximately 3 minutes and 45 seconds of data from the accident flight landing. Each parameter was sampled and recorded at a rate of 10 times per second (10Hz).

The airplane manufacturer/operator provided the following clarification regarding the power lever ground fine position parameter in the flight test data:

"Power Lever Ground Fine Position² is measured via a mechanical attachment on the power levers and can often provide intermittent contact with varied results. On the accident run, the initial selection of Ground Fine [in the data] is correct, but the indication did not remain steady."

²Power Lever Ground Fine Position² is displayed as 'PL GrndFine-L/R' in the plots and tabular data. See Table 2 for details.

3.0 Engineering Unit Conversions

The engineering unit conversions used for the CVDR data contained in this report are based on documentation from the airplane manufacturer/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=+).³

The flight test data in the .XLSX file was provided in engineering units, thus, no further conversion was necessary.

Table 1 lists the CVDR parameters verified and provided in this report. Table 2 lists the flight test data parameters verified and provided in this report. Table 3 describes the unit abbreviations used in this report.

4.0 Time Correlation

Correlation of the CVDR data from SRN to the event local time, CDT, was established by using the recorded coordinated universal time (UTC) hours, UTC minutes, and UTC seconds and then applying an additional 5-hour offset to change UTC to CDT.

Accordingly, the time offset for the event flight data from SRN to local CDT is the following: CVDR CDT = SRN - 269823.

Each line of data in the flight test .XLSX file included a timestamp in UTC. A 5-hour offset was applied to change UTC to local time, CDT.

In this report, all times are referenced as CDT unless otherwise noted.

E. FIGURES AND TABULAR DATA

Figures 1 to 3 contain CVDR and flight test data recorded during the accident flight on May 21, 2022. Note that the test condition of the accident flight included shutting down and securing engine 1 (the left engine) while airborne.

Figure 1 contains CVDR and flight test data for the accident flight landing, from 16:27:45 to 16:28:45 CDT.

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 = +.

Figure 2 contains flight test parameters for the full duration of the provided .XLSX file, from 16:25:03 to 16:28:47 CDT.

Figure 3 contains CVDR data for the full accident flight, from 16:15:00 to 16:29:00 CDT.

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.

Submitted by:

Kyle Garner
Sr. Aerospace Engineer (Recorder Specialist)

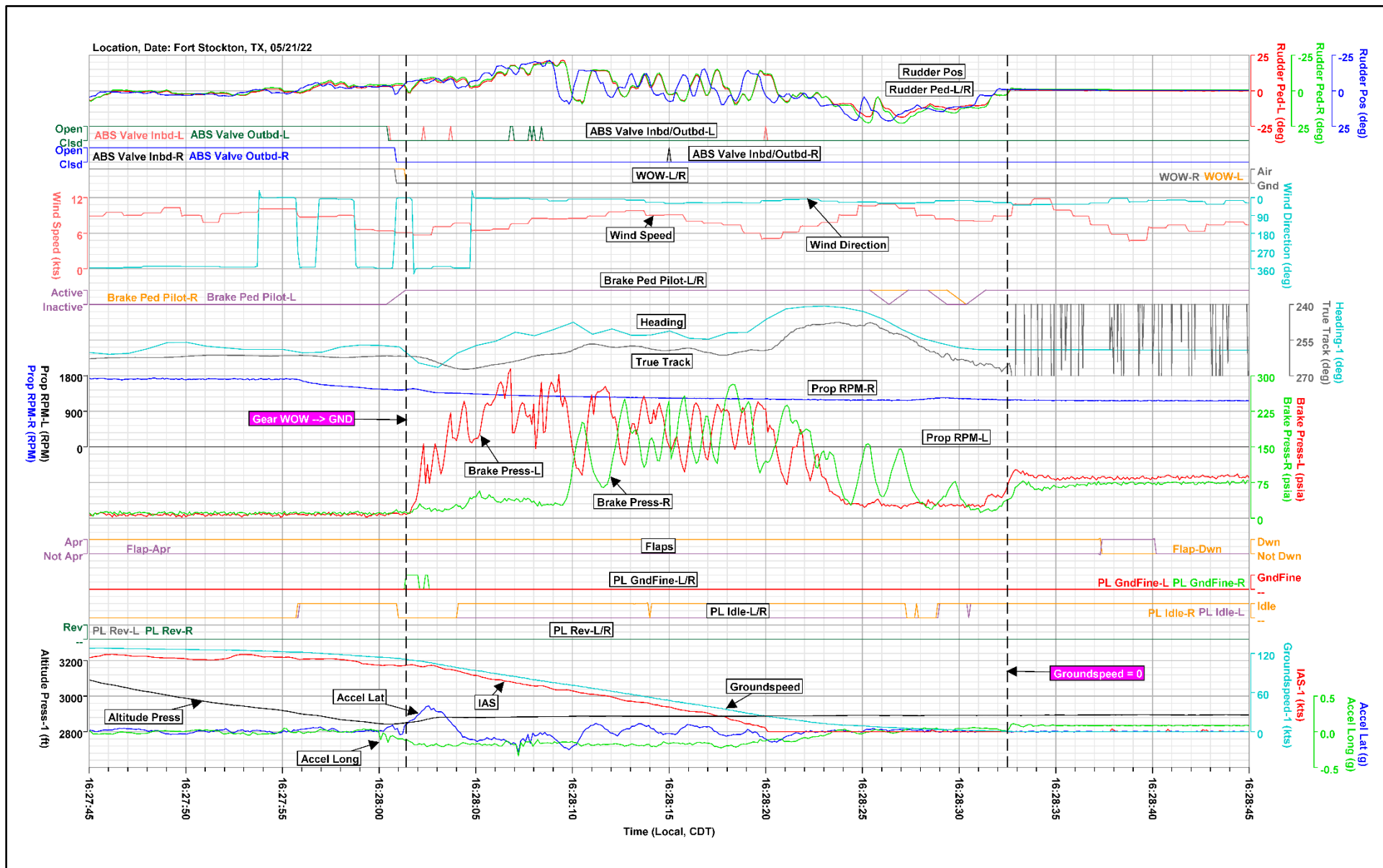


Figure 1. Accident flight landing, flight test data and CVDR data - 16:27:45 to 16:28:45 CDT.

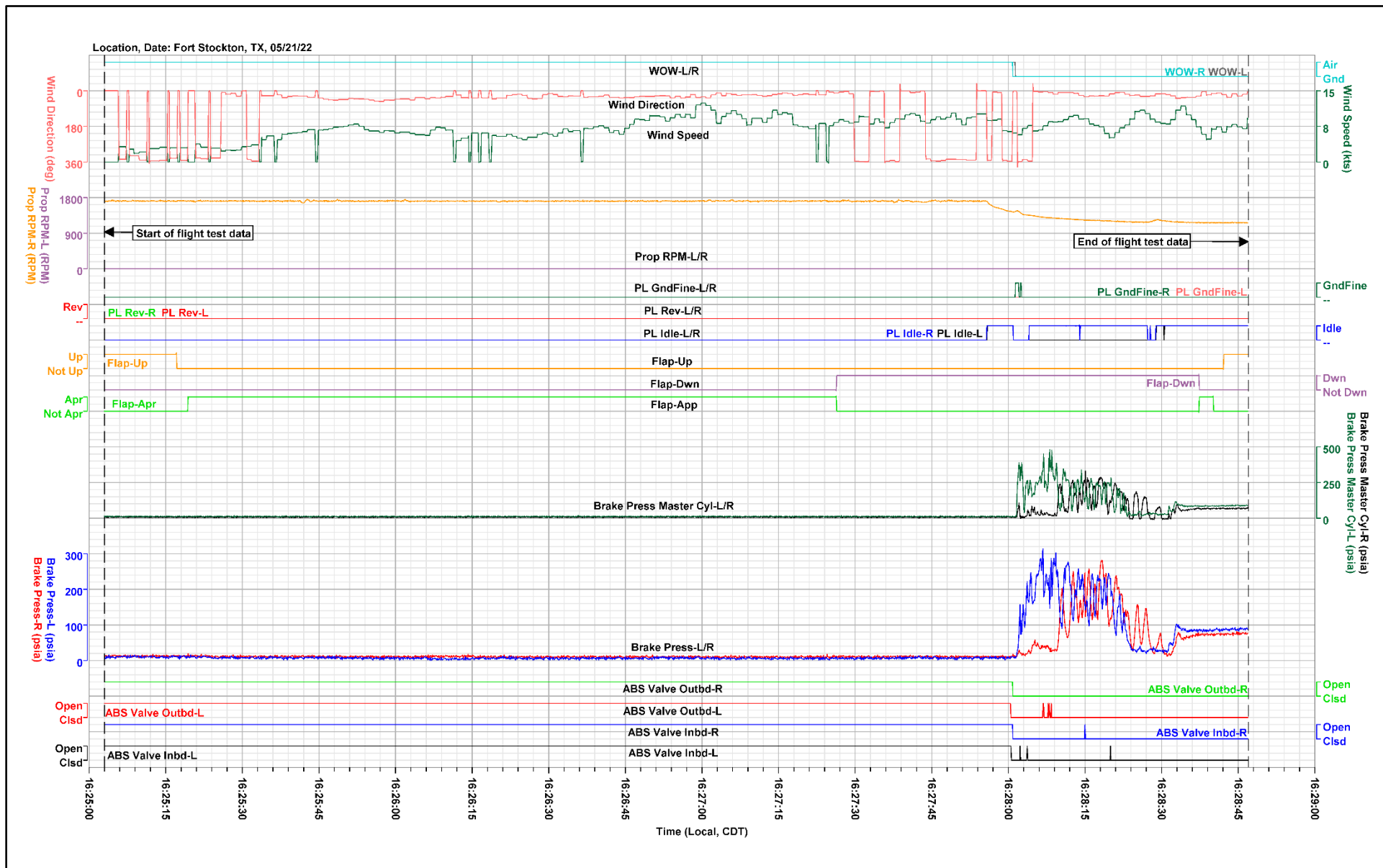


Figure 2. Accident flight, flight test data only - 16:25:03 to 16:28:47 CDT.

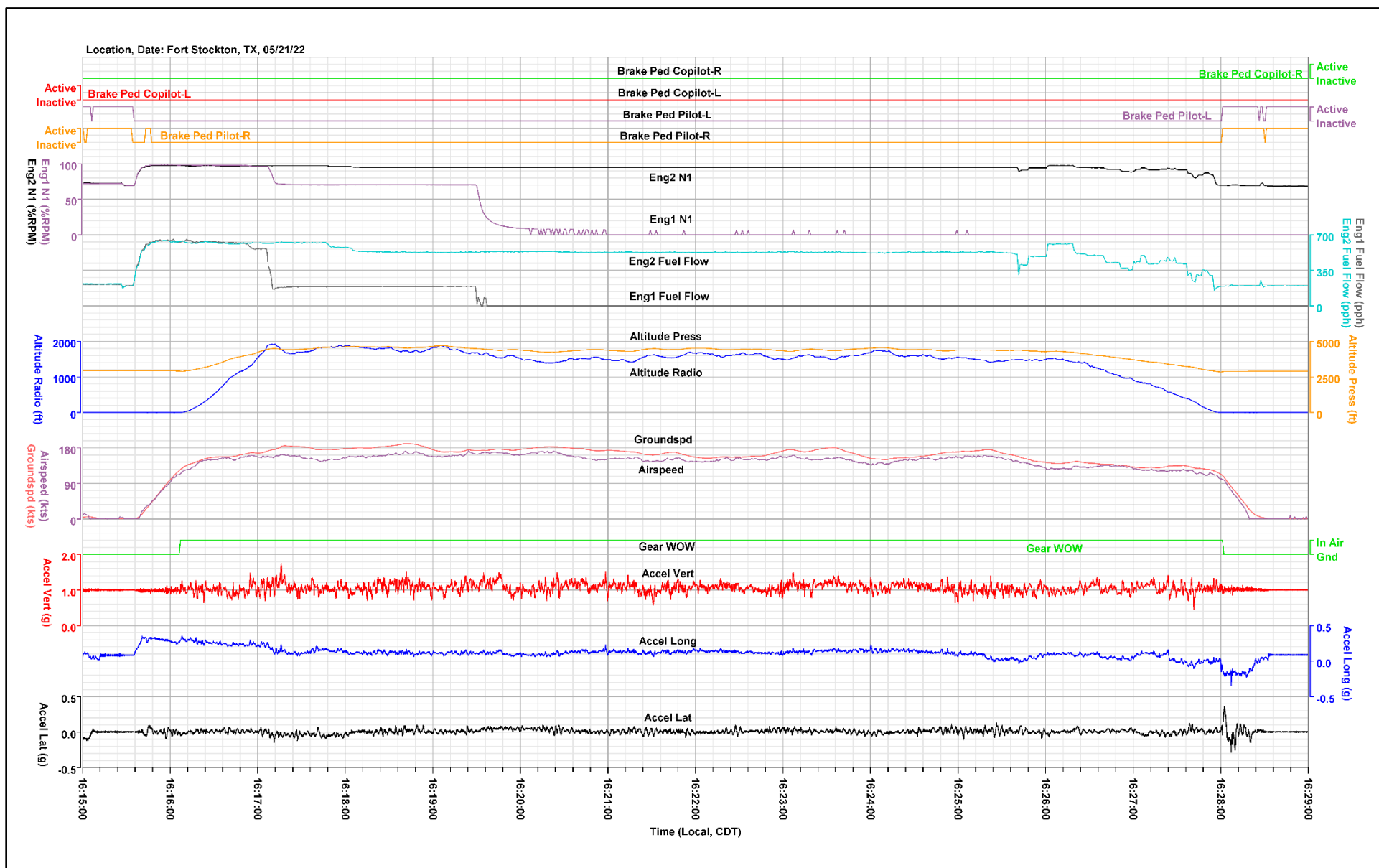


Figure 3. Accident flight, CVDR data only - 16:15:00 to 16:29:00 CDT.

APPENDIX A. VERIFIED AND PROVIDED PARAMETERS

This appendix describes the parameters provided and verified in this report. Table 1 lists the parameters sourced from the CVDR. Table 2 lists the parameters sourced from the XLSX flight test data. Additionally, Table 3 describes the unit abbreviations used in this report.

Table 1. Verified and provided CVDR parameters⁴.

Plot/Table Labels	Parameter Names	Units
Accel Lat	Lateral Acceleration	g
Accel Long	Longitudinal Acceleration	g
Accel Vert	Vertical/Normal Acceleration	g
Airspeed	Calibrated Airspeed	kts
Altitude Press	Pressure Altitude	ft
Altitude Radio	Radio Altitude	ft
Brake Ped Copilot-L/R	Brake Pedal Active Copilot-Left/Right	-
Brake Ped Pilot-L/R	Brake Pedal Active Pilot-Left/Right	-
Eng1/2 Fuel Flow	Engine 1/2 Fuel Flow	pph
Eng1/2 N1	Engine 1/2 N1	%RPM
Gear WOW	Gear Weight-on-Wheels	-
Groundspd	Groundspeed	kts
Heading	Magnetic Heading	deg
Pitch*	Pitch	deg
Roll*	Roll	deg
Rudder Pos	Rudder Position	deg
Time-Hrs	Time-Hours	hrs
Time-Min	Time-Minutes	min
Time-Sec	Time-Seconds	sec
Wind Direction	Wind Direction	deg
Wind Speed	Wind Speed	kts

Note: This CVDR 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 CVDR plots and in the electronic data has not been corrected for the local altimeter setting at the time of the event.

Note: Parameters with a blank unit description in table 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.

Table 2. Verified and provided flight test data parameters.

Plot/Table Labels	Parameter Names	Units
ABS Valve Inbd-L/R	Antiskid Brake System Valve Inboard-Left/Right	-
ABS Valve Outbd-L/R	Antiskid Brake System Valve Outboard-Left/Right	-
Altitude Press-1	Pressure Altitude-Air Data Computer 1	ft
Brake Press Master Cyl-L/R	Brake Pressure at Master Cylinder-Left/Right	psia
Brake Press-L/R	Brake Pressure at Brake Assembly-Left/Right	psia
Flap-Apr/Dwn/Up	Flap Position-Approach/Down/Up	-
Groundspeed-1	Groundspeed-GPS 1	kts

⁴ Parameters with a * are not plotted and only provided in tabular data.

Plot/Table Labels	Parameter Names	Units
Heading Mag-1	Magnetic Heading	deg
IAS-1	Indicated Airspeed-Air Data Computer 1	kts
PL GrndFine-L/R	Power Lever Ground Fine Position-Left/Right	-
PL Idle-L/R	Power Lever Idle Position-Left/Right	-
PL Rev-L/R	Power Lever Reverser Position-Left/Right	-
Prop RPM-L/R	Propeller RPM-Left/Right	RPM
Rudder Ped-L/R	Rudder Pedal Position-Left/Right	deg
Wind Direction	Wind Direction	deg
Wind Speed	Wind Speed	kts
WOW-L/R	Weight-on-Wheels-Left/Right	-

Table 3. Unit abbreviations.

Unit Abbreviations	Descriptions
deg	degrees
ft	feet
g	unit of gravitation acceleration
hrs	hours
kts	knots
min	minutes
pph	pounds per hour
psia	pounds per square inch absolute
RPM	revolutions per minute
sec	seconds