

National Transportation Safety Board

Office of Research and Engineering

Washington, DC 20594



DCA22LA126

FLIGHT DATA RECORDER

Specialist's Factual Report

February 8, 2023

A. INCIDENT

Location: Tulsa, Oklahoma
Date: June 8, 2022
Time: 0413 central daylight time (CDT)
0913 universal coordinated time (UTC)
Airplane: Boeing 757-200, FDX1170, N949FD

B. FLIGHT DATA RECORDER SPECIALIST

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

C. FEDERAL CARRIAGE REQUIREMENTS

The event aircraft, N949FD was operating as Title 14 *Code of Federal Regulations* (CFR) Part 121. The event aircraft was manufactured in May 1991 and was operating such that it was required to be equipped with a flight data recorder (FDR) that recorded, at a minimum, 22 parameters, as cited in 14 CFR Part 121.344(c).

D. DETAILS OF THE INVESTIGATION

An FDR group was not convened. The NTSB Vehicle Recorder Division received the following combined voice and flight data recorder (CVFDR):

Recorder Manufacturer/Model: Smiths Industries CVFDR
Part Number: 175497-01-01
Recorder Serial Number: 0000638

1.0 Smith Industries CVFDR Description

The Smiths Industries Combi Recorder 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 Combi 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 Combi is designed to meet the crash-survivability requirements of TSO-C123a and TSO-C124a.

1.1 Recorder Condition

The recorder was in good condition and the data were extracted normally from the recorder. Figure 1 shows the CVFDR as received by the NTSB Vehicle Recorder Division.



Figure 1. CVFDR as received by the NTSB Vehicle Recorder Division

1.2 Recording Description

The FDR recording contained approximately 26.38 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 40 minutes. The parameters evaluated for the purpose of this report appeared to be in accordance with federal FDR carriage requirements.

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 aircraft was on the ground, the following parameter recorded a NCD pattern: computed airspeed (Airspeed Comp).

For a discussion of the CVR audio data, see Cockpit Voice Recorder (CVR) - Specialist's Factual Report, which can be found in the public docket for this accident.

1.2.1 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=+).¹

1.3 Time Correlation

Correlation of the FDR data from SRN to the event local time, CDT, was established by using the recorded Greenwich Mean Time (GMT) Hours, GMT Minutes, and GMT seconds and then applying an additional 6 hour offset to change GMT to CDT.

Accordingly, the time offset for the event flight data from SRN to CDT is the following: $FDR\ CDT = SRN - 79249.875$.

Therefore, for the rest of this report, all times are referenced as CDT, unless otherwise noted.

E. FIGURES AND TABULAR DATA

Data obtained from the Smith Industries CVFDR S/N: 0000638 was used to produce the following overlays and tabular data. Figure 2 through Figure 7 were generated using the data downloaded from this device.

Figure 2 through Figure 4 show time histories of the entire flight, the approach and landing, and the landing sequence, respectively. 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 data show the following:

- **03:33:17** - FedEx Flight 1170 began takeoff roll on runway 16L from Fort Worth Alliance Airport (KAFW), Fort Worth, TX.
- **03:37:49** - The left autopilot was engaged.

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 = +.

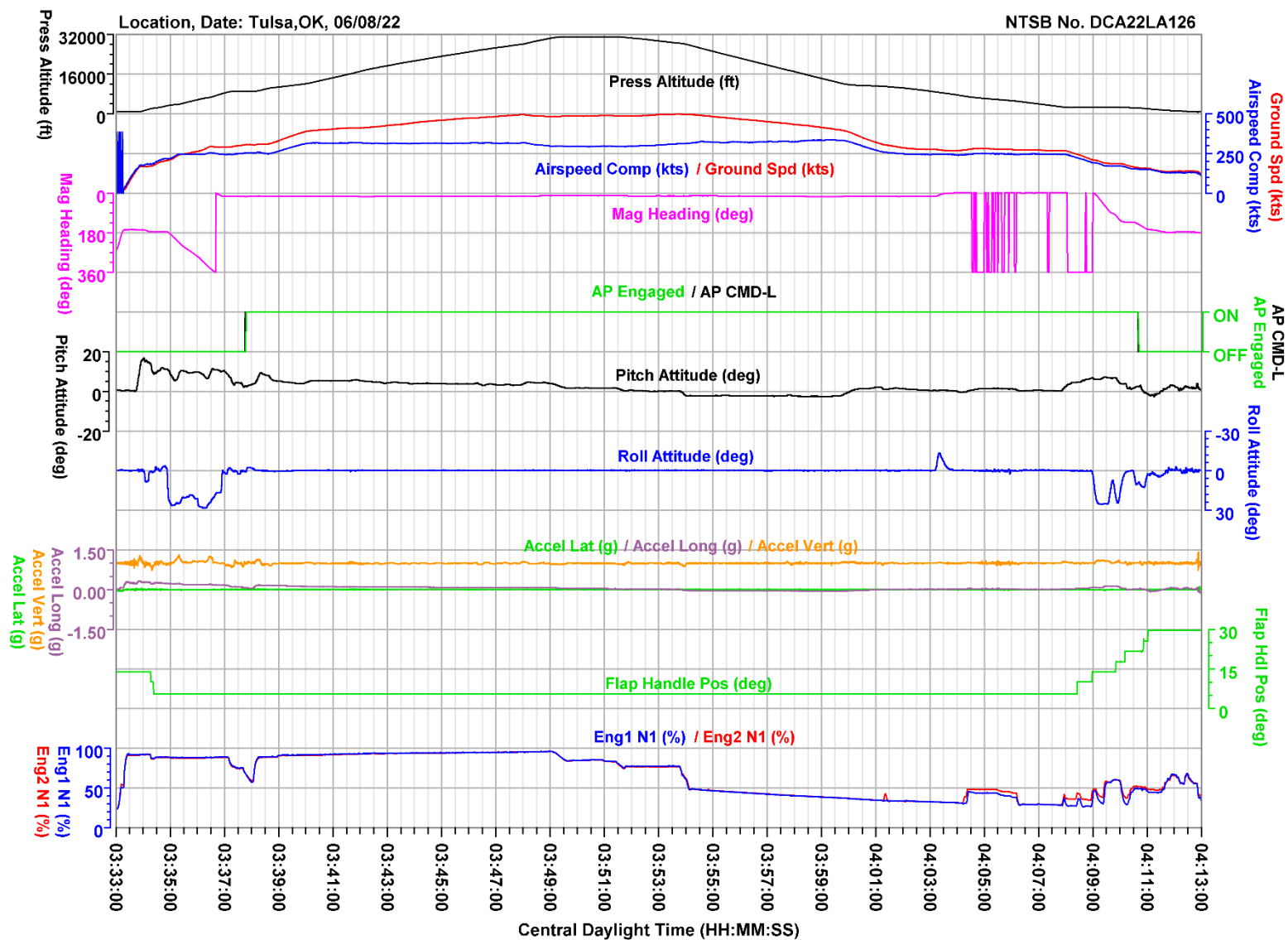
- **03:49:26** - The aircraft reached cruising altitude of 31,000 ft pressure altitude, with a computed airspeed of 296 kts (484 kts ground speed) and a magnetic heading of 013 degrees.
- **03:51:24** - The aircraft began a descent for landing.
- **04:00:00** - The aircraft began to arrest the descent at 11733 ft pressure altitude at an airspeed of 323 kts (385 kts ground speed), and a magnetic heading of 16 degrees.
- **04:08:17** - The aircraft leveled off at 2546 ft pressure altitude at an airspeed of 230 kts (251 kts ground speed) and a magnetic heading of 000 degrees.
- **04:10:43** - The autopilot was disengaged.
- **04:11:30** - The aircraft reached a magnetic heading of 174 degrees, a computed airspeed of 132 knots, and a pressure altitude of 1539 feet. The Localizer and Glideslope deviation was -4.10 dots and +0.43 dots, respectively.
- **04:12:53** - The aircraft touched down on runway 18R and began landing rollout (36.203040 deg N, 95.899654 deg W).
- **04:13:22** - The aircraft slowed below 15 knots ground speed approximately 638 feet from the end of runway 18R at Tulsa International Airport (KTUL).

Figure 5 through Figure 7 show Google Earth overlays of the entire incident route, the approach and landing, and the landing sequence, respectively. Note that the weather and lighting conditions in Google Earth are not necessarily the weather and lighting conditions present at the time of the recording.

The tabular data for the entire flight event from 03:33:10 CDT to 04:13:25 CDT for all the parameters listed in Table 1 are provided in electronic comma separated value (CSV) format as attachment 1 to this report.

Submitted by:

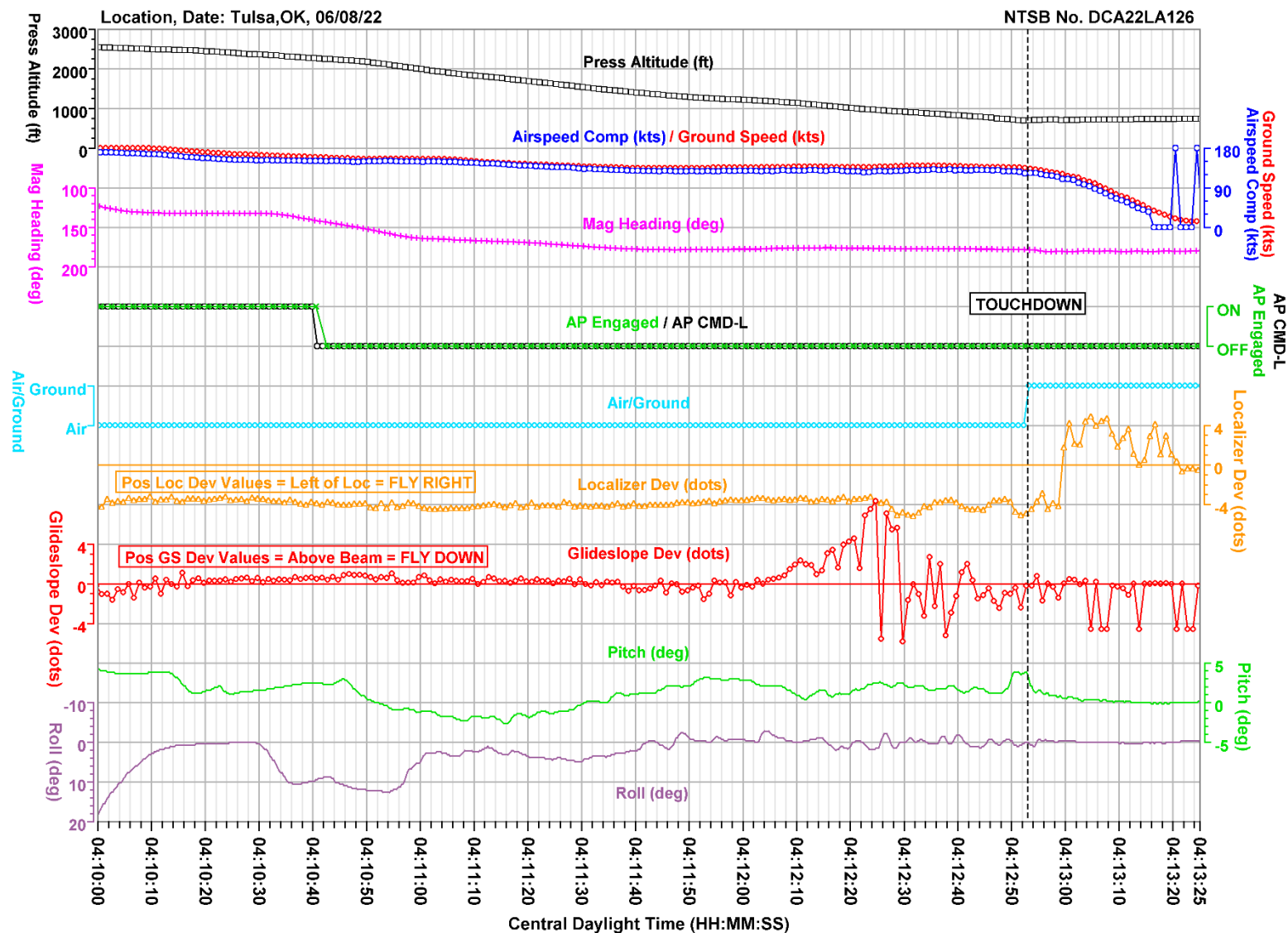
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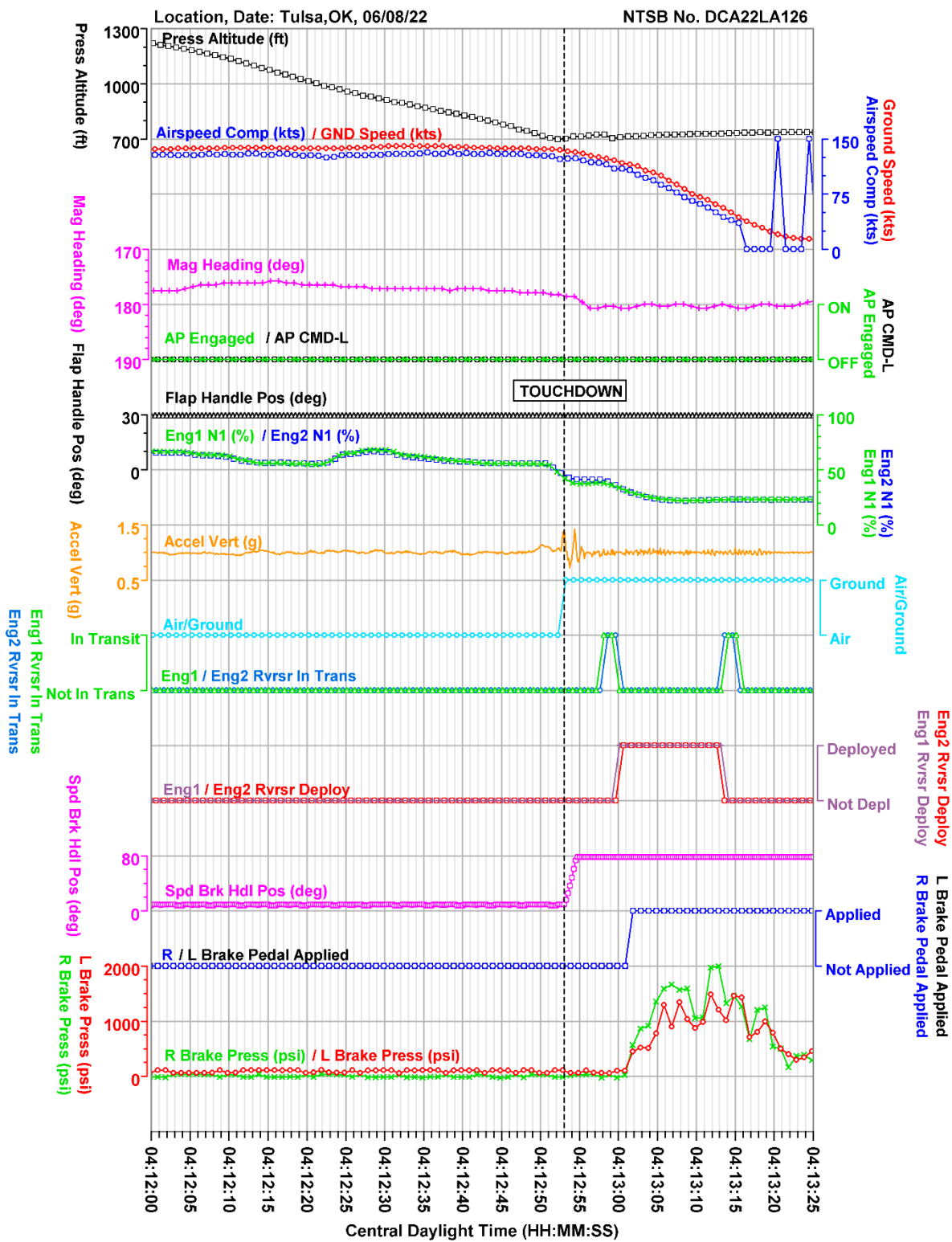
Figure 2. Time history plot of the entire flight from Fort Worth Alliance to Tulsa International Airport.



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Figure 3. Time history plot of the aircraft approach and landing.



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Figure 4. Time history plot of engine and basic aircraft parameters at landing.

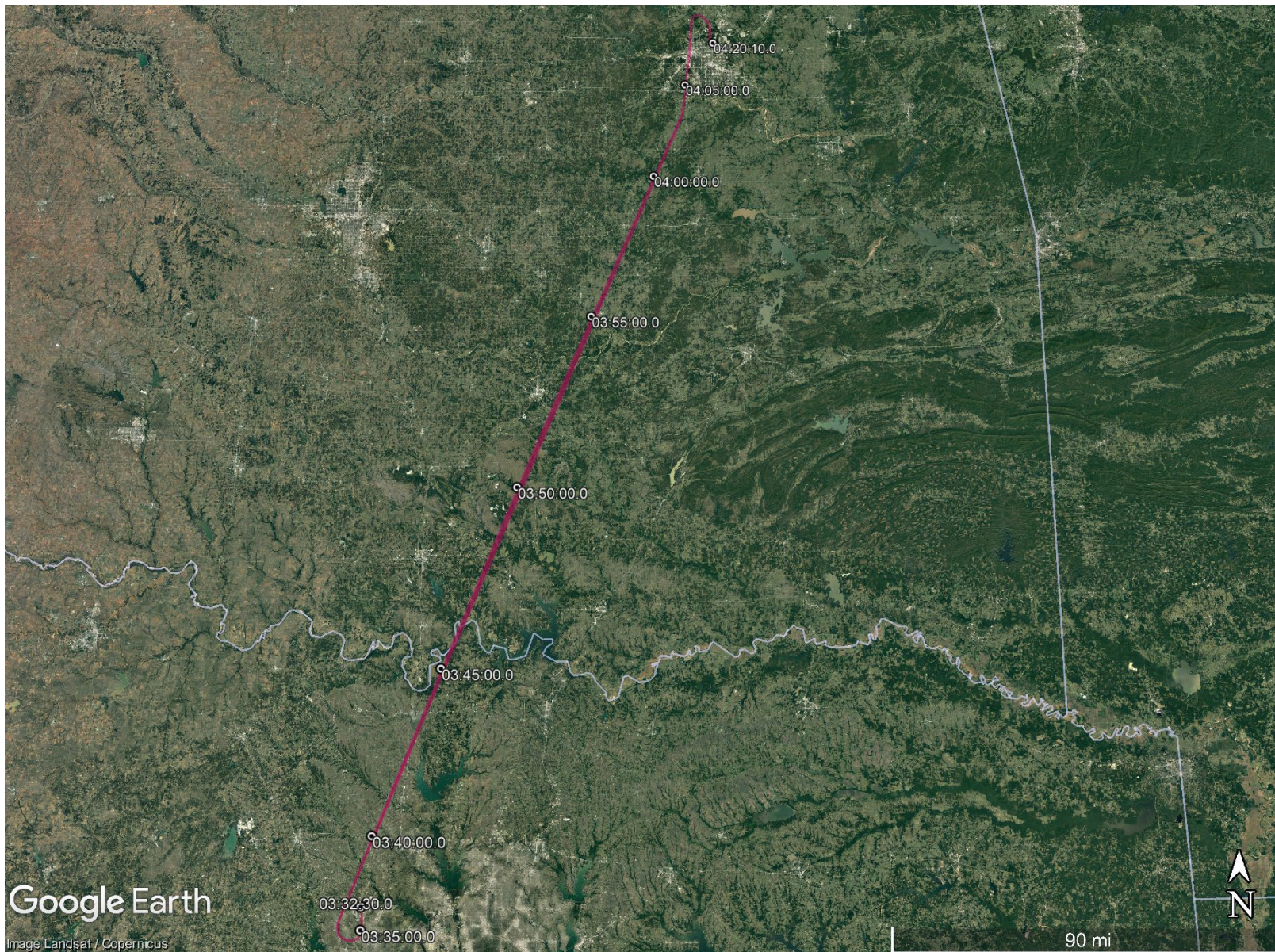


Figure 5. Google Earth image of the entire flight path from Fort Worth Alliance Airport to Tulsa International Airport.

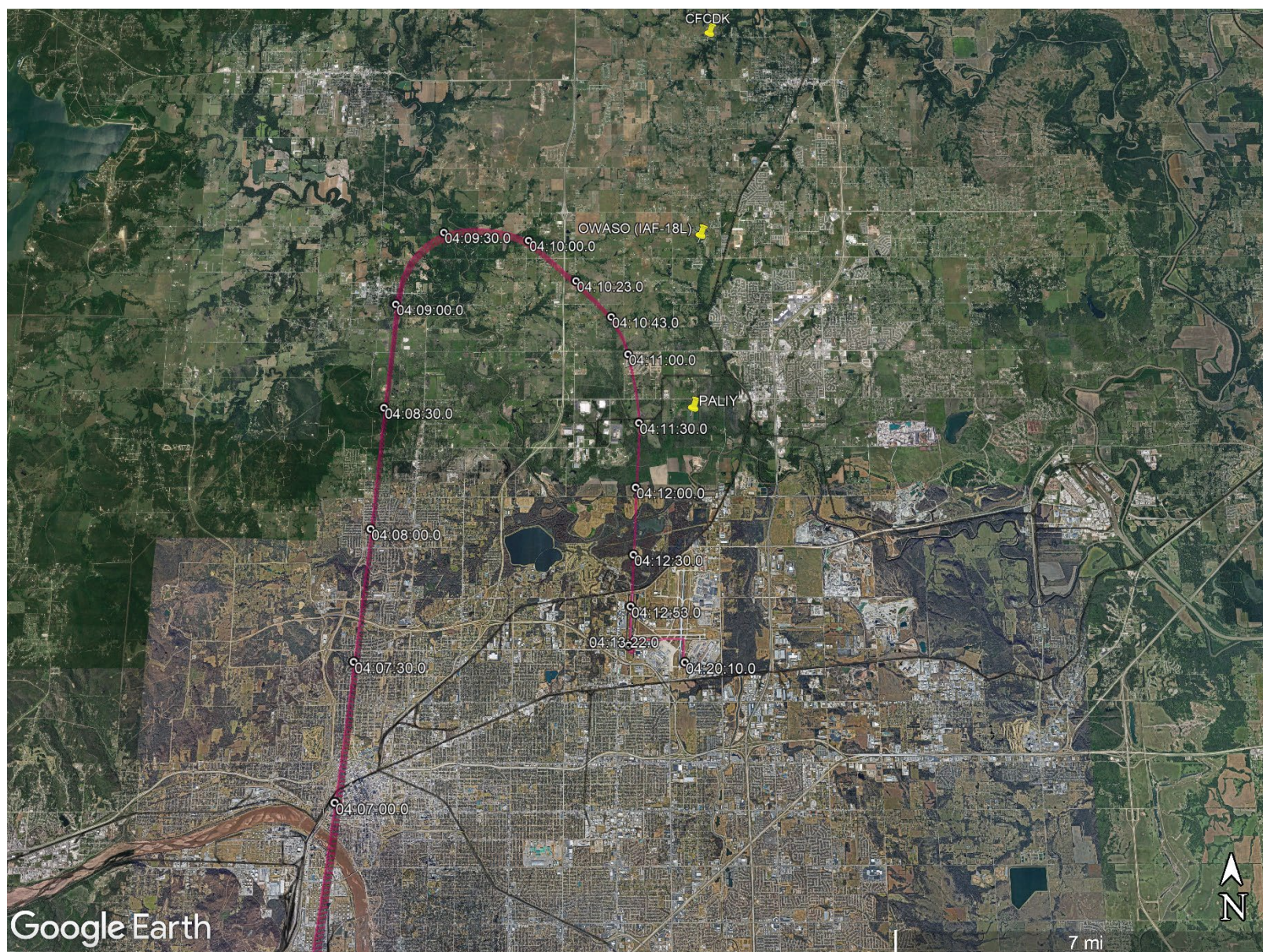


Figure 6. Google Earth image of the approach pattern pilots took landing on runway 18R and yellow pins for ILS waypoints for runway 18L.



Figure 7. Google Earth image of the approach and touchdown point all the way to full stop.

APPENDIX A. VERIFIED AND PROVIDED PARAMETERS

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

Table 1. Verified and provided FDR parameters

Plot/Table Labels	Parameter Names	Units
Accel Lat	Lateral Load Factor	g
Accel Long	Longitudinal Load Factor	g
Accel Vert	Vertical Load Factor	g
Airspeed Comp	Computed Airspeed	kts
Air/Ground	Air-Ground Switch	
Altitude Press	Pressure Altitude	ft
AP Engaged	Autopilot Engaged	
Brake Pedal Applied - R	Brake Pedal Applied - Right	
Brake Pedal Applied - L	Brake Pedal Applied - Left	
Brake Pressure - R	Brake Pressure - Right Main Landing Gear	psi
Brake Pressure - L	Brake Pressure - Left Main Landing Gear	psi
Eng1 N1	Engine 1 Fan Speed	%
Eng2 N1	Engine 2 Fan Speed	%
Eng1 Rvrslr Deploy	Engine 1 Thrust Reverser Deployed	
Eng2 Rvrslr Deploy	Engine 2 Thrust Reverser Deployed	
Eng1 Rvrslr in Trans	Engine 1 Reverser in Transit	
Eng2 Rvrslr in Trans	Engine 2 Reverser in Transit	
Flap Handle Pos	Flap Handle Position	deg
Ground Spd	Ground Speed	kts
Heading	Magnetic Heading	deg
Key VHF-1	Microphone Keying-1	
Key VHF-2	Microphone Keying-2	
Latitude	Latitude Coordinate	deg
Longitude	Longitude Coordinate	deg
Pitch Attitude	Pitch Angle	deg
Roll Attitude	Roll Angle	deg
Spd Brk Hdl Pos	Speed Brake Handle Position	deg
Time GMT Hrs	Greenwich Mean Time Hours	hrs
Time GMT Min	Greenwich Mean Time Minutes	min
Time GMT Sec	Greenwich Mean Time Seconds	sec

Table 2. Unit and discrete state abbreviations

Unit and Discrete State Abbreviations	Descriptions
%rpm	percent revolutions per minute
deg	degrees
degC	degrees Celsius
Eng	Engaged
ft	feet
g	unit of gravitation acceleration
hrs	hours
kg	kilograms
kts	knots
min	minutes
psi	pounds per square inch
sec	seconds