

National Transportation Safety Board

Office of Research and Engineering

Washington, DC 20594



DCA22FA132

FLIGHT DATA RECORDER

Specialist's Factual Report

March 1, 2023

A. ACCIDENT

Location: Miami, Florida
Date: June 21, 2022
Time: 1738 eastern daylight time
2138 universal coordinated time
Airplane: Boeing (McDonnell Douglas) DC-9-82, HI-1064, RED Air flight 203

B. FLIGHT DATA RECORDER SPECIALIST

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

C. FEDERAL CARRIAGE REQUIREMENTS

The event aircraft, HI-1064, was operating as Title 14 *Code of Federal Regulations* (CFR) Part 129. The event aircraft was manufactured in 1990 and was operating such that it was required to be equipped with a Flight Data Recorder (FDR) that recorded, at a minimum, 32 parameters, as cited in Annex 6 (Part I).

As cited in 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 §6.3.1.1.3, "All aeroplanes of a maximum certificated take-off mass of over 27000 kg for which the individual certificate of airworthiness is first issued on or after 1 January 1989 shall be equipped with an FDR which shall record at least the first 32 parameters listed in Table A8-1 of Appendix 8."

D. DETAILS OF THE INVESTIGATION

An FDR group was not convened. The NTSB Vehicle Recorder Division received the following FDR:

Recorder Manufacturer/Model: Fairchild Model F1000
Part Number: S903-2000-00
Recorder Serial Number: 00377

1.0 Fairchild Model F1000 Description

This model FDR records airplane flight information in a digital format using solid-state flash memory as the recording medium. The F1000 can receive data in the ARINC 573/717/747/542a configurations and can record a minimum of 25 hours of flight data. It is configured to record 64 12-bit words of digital information every

second. Each grouping of 64 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 64-word intervals. Each data parameter (e.g., altitude, heading, airspeed) has a specifically assigned word number within the subframe. The F1000 is designed to meet the crash-survivability requirements of TSO-C124.

1.1 Recorder Condition

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

1.2 Recording Description

The FDR recording contained approximately 48 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 2 hours and 7 minutes. The parameters evaluated for the purpose of this report appeared to be in accordance with the ICAO Standard, except Radio Altitude and Ground Spoiler/speed brake selection (selection and position). The operator was informed of these parameter deficiencies.

1.2.1 Engineering Unit Conversions

The engineering unit conversions used for the data contained in this report are based on documentation from the previous 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=+).¹

Table 1 lists the FDR parameters verified and provided in this report. Additionally, Table 2 describes the unit and discrete state abbreviations used in this report.

In addition to the parameters contained in the documentation, two additional parameters were identified that were pertinent to the investigation, radio altitude and right inboard spoiler position. However, due to a lack of documentation for these parameters, conversion from raw data to engineering units was not possible. Therefore, these two parameters are presented in raw counts.

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 = +, Left Aileron Trailing Edge Down = -, Right Aileron Trailing Edge Up = +, Pitch Up = +, Elevator Trailing Edge Up = +, Right Rudder = +.

1.3 Time Correlation

Correlation of the FDR data from SRN was not possible as the recorder did not record the Time parameter in UTC. Therefore, no offset or time correlation was conducted, and the time history plots are left in raw SRN.

E. FIGURES AND TABULAR DATA

Data obtained from the Fairchild Model F1000 S/N: 00377 was used to produce the following overlays and tabular data. Figures 1 through 5 were generated using the data downloaded from this device. Note for the event flight, the recording stopped capturing data over a 16 second period (**SRN 173374** to **SRN 173389**) before the recording began again (**SRN 173390**).

Figures 1 through 5 show time histories of the entire flight, the approach and landing, the landing sequence, engine parameters on approach and landing, and engine parameters in 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 shows the following:

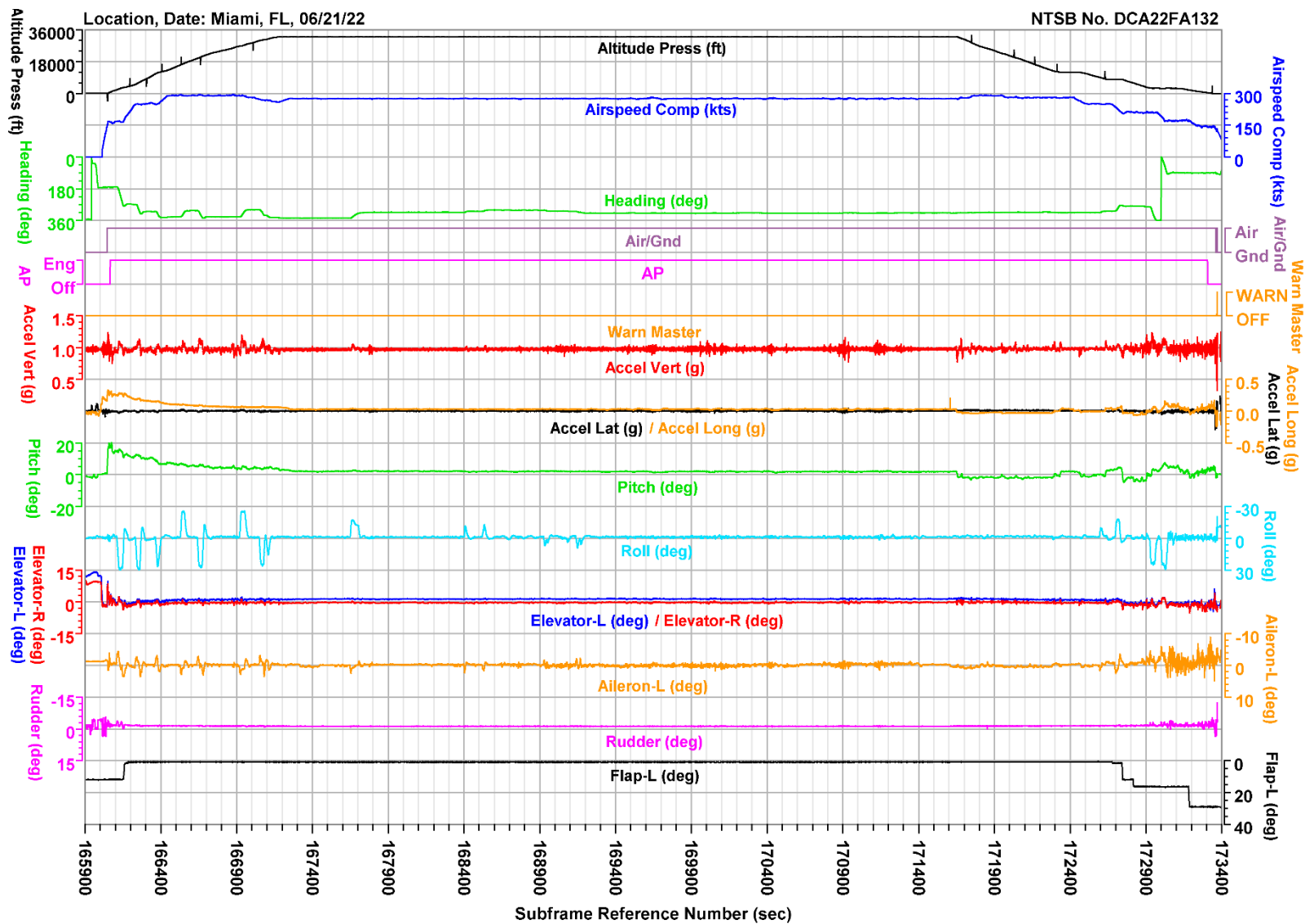
- **SRN 166016** - The flight began its takeoff roll from Santo Domingo, Dominican Republic to Miami, Florida.
- **SRN 167186** - The aircraft reached FL320 at a computed airspeed of 260 knots and a magnetic heading of 345 degrees.
- **SRN 171658** - The aircraft began the initial descent to FL120.
- **SRN 173121** - The aircraft captured glideslope at a pressure altitude of 2,800 feet, 169 knots computed airspeed, and a magnetic heading of 90 degrees. The autopilot (AP) was still engaged, and the right landing gear remained in the up position.
- **SRN 173180** - The right landing gear status changed from up, to down. The AP was still engaged. The pressure altitude was 1,972 feet, the computed airspeed was 169 knots, and the magnetic heading was 90 degrees. The flap setting was changed from 16 degrees to 29 degrees.
- **SRN 173309** - The AP was disengaged, while the aircraft was at a pressure altitude of 349 feet, 141 knots of computed airspeed, and a magnetic heading of 90 degrees.
- **SRN 173361** - The Air/Ground switch registered a change from Air to Ground. Note, the Air/Ground switch is linked to the nose gear rather than the main gear.
- **SRN 173362** - The Air/Ground switch changed to Air.

- **SRN 173363** - Left Brake Pressure increased from 0 psi to 166 psi, while the Right Brake Pressure remained at 0 psi. The Air/Ground switched to Ground.
- **SRN 173368** - Left Brake Pressure increased from 166 psi to 2381 psi, while the Right Brake Pressure remained at 0 psi.
- **SRN 173370** - The Master Warning alert was activated. The Air/Ground switch changed to Air.
- **SRN 173371** - Engines 1 and 2 Thrust Reversers unlocked and deployed. Engines 1 and 2 N1 showed spikes, consistent with thrust reverser activation. The Left Brake Pressure showed 161 psi. An engine fire alert was recorded on engine 1. The Air/Ground switched to Ground.
- **SRN 173373** - Last valid data point before a 16 second lapse of recording.
- **SRN 173390** - Data capture resumes. The aircraft recorder showed a magnetic heading of 99 degrees and a computed airspeed of 99 knots. The Master Warning and Fire warning were no longer active at this time. The Air/Ground switch showed the aircraft on the Ground.
- **SRN 173402** - The recording ended.

The corresponding tabular data used to create figures 1 through 5 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:

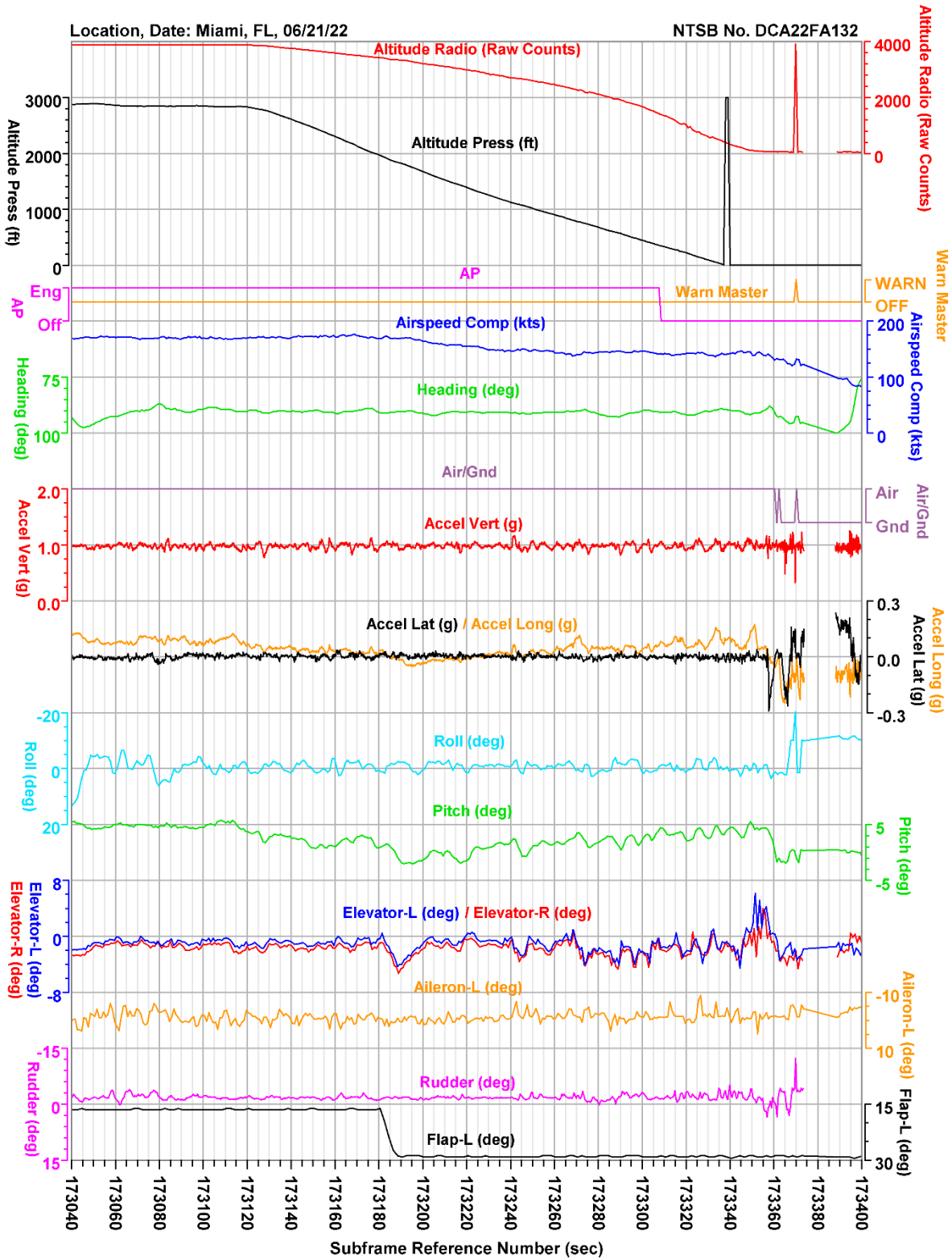
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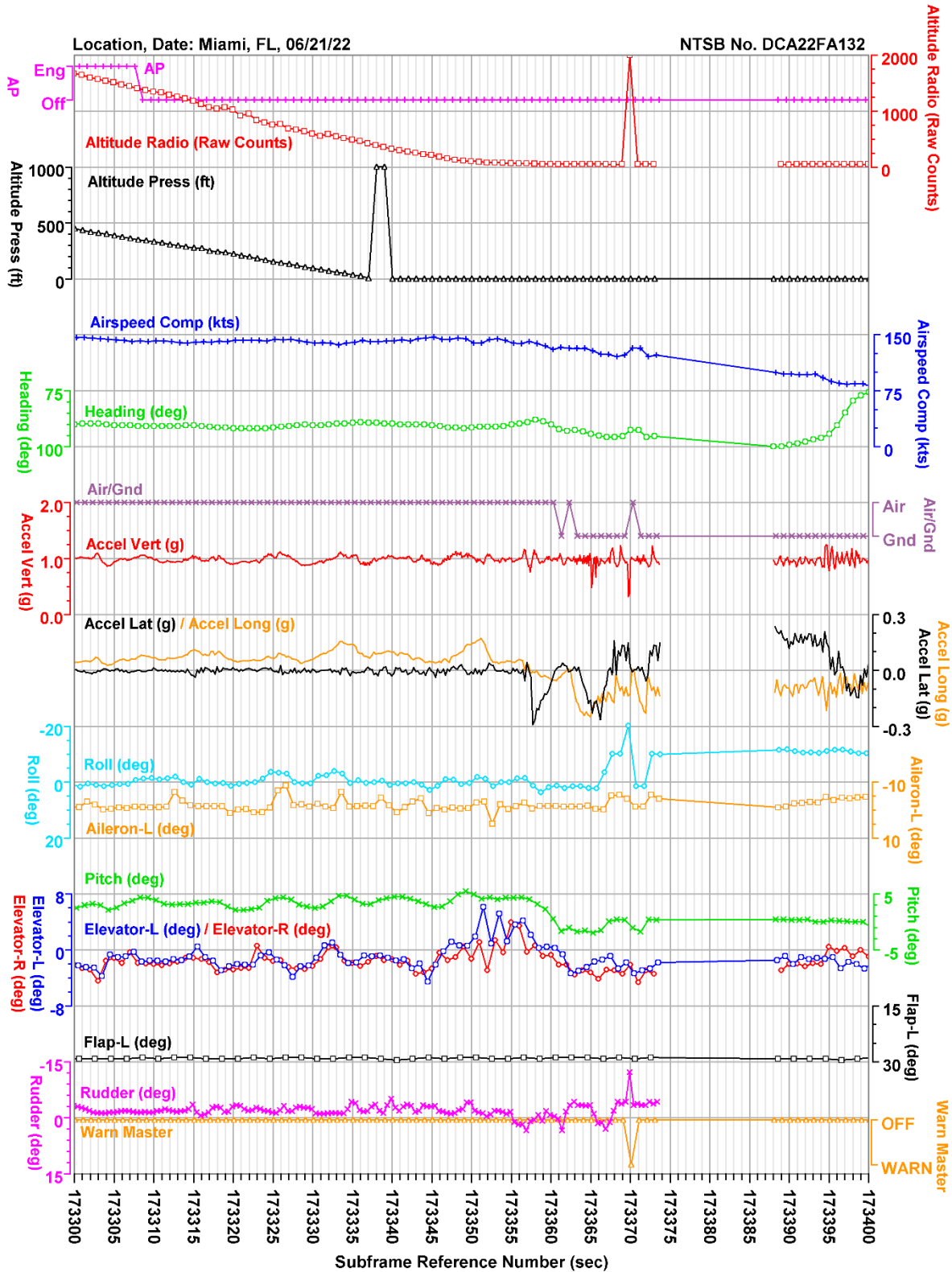
Figure 1. Time History plot of the entire flight in SRN.



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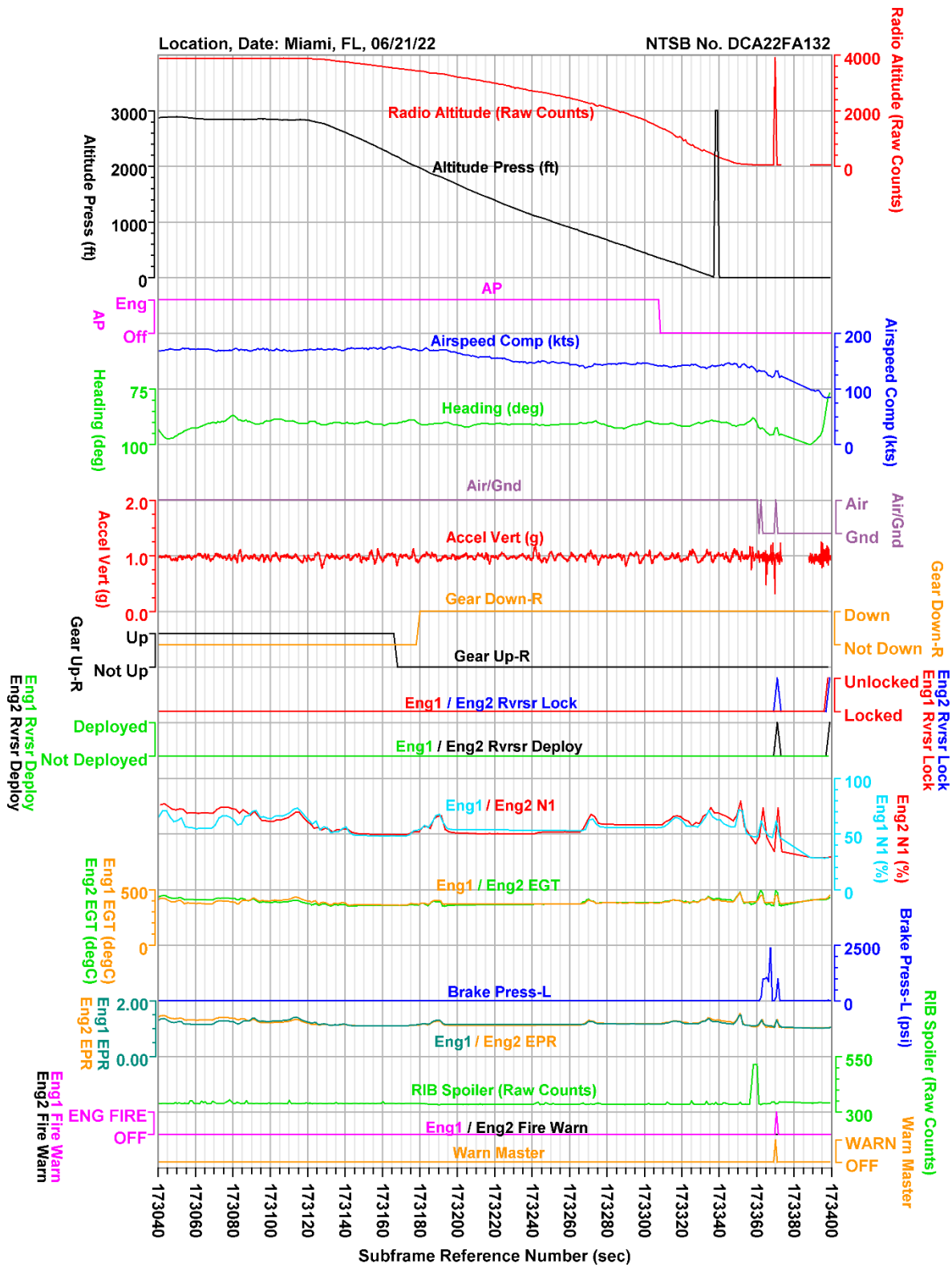
Figure 2. Time history plot of the approach and landing.



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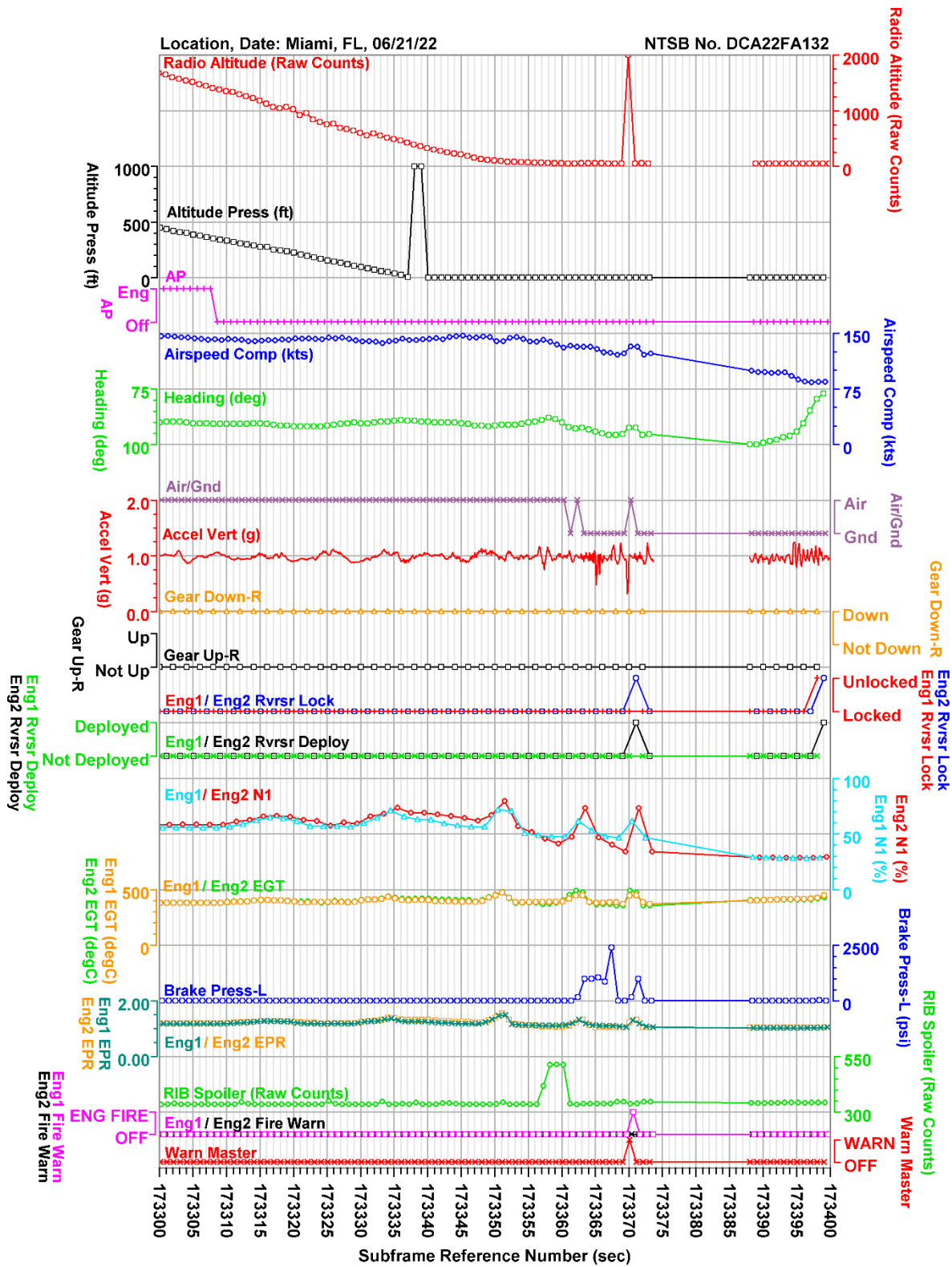
Figure 3. Time history plot of the landing.



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Figure 4. Time history plot of the engine parameters during approach and landing.



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Figure 5. Time history plot of engine parameters during landing.

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 state abbreviations used in this report.

Table 1. Verified and provided FDR parameters

Plot/Table Labels	Parameter Names	Units
Accel Lat	Lateral Acceleration	g
Accel Long	Longitudinal Acceleration	g
Accel Vert	Vertical Acceleration	g
Aileron-L	Left Aileron Position	deg
Air/Gnd	Air/Ground Switch	
Airspeed Comp	Computed Airspeed	kts
Altitude Press	Pressure Altitude	ft
Altitude Radio	Radio Altitude	Raw Counts
AP	Autopilot Engaged	
Brake Pressure-L	Left Brake Pressure	psi
Elevator-L	Left Elevator Position	deg
Elevator-R	Right Elevator Position	deg
Eng1 EGT	Engine 1 Exhaust Gas Temperature	degC
Eng1 EPR	Engine 1 Engine Pressure Ratio	
Eng1 Fire Warn	Engine 1 Fire Warning	
Eng1 N1	Engine 1 Fan Speed	%
Eng1 Rvrsr Deploy	Engine 1 Thrust Reverser Deployed	
Eng1 Rvrsr Lock	Engine 1 Thrust Reverser Locked	
Eng2 EGT	Engine 2 Exhaust Gas Temperature	degC
Eng2 EPR	Engine 2 Engine Pressure Ratio	
Eng2 Fire Warn	Engine 2 Fire Warning	
Eng2 N1	Engine 2 Fan Speed	%
Eng2 Rvrsr Deploy	Engine 2 Thrust Reverser Deployed	
Eng2 Rvrsr Lock	Engine 2 Thrust Reverser Locked	
Gear Down-R	Right Gear Down	
Gear-Up-R	Right Gear Up	
Flap Surface Pos-L	Flap Surface Position-Left	deg
Heading	Magnetic Heading	deg
Pitch	Pitch Angle	deg
RIB Spoiler	Right Inboard Spoiler	Raw Counts
Roll	Roll Angle	deg
Rudder	Rudder Position	deg
Warn Master	Master Warning	

Note: 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 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 discretets. 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. Unit and discrete state abbreviations

Unit and Discrete State Abbreviations	Descriptions
%	percent
deg	degrees
degC	degrees Celsius
Eng	Engaged
ft	feet
g	unit of gravitation acceleration
Gnd	ground
kts	knots
psi	pounds per square inch