NATIONAL TRANSPORTATION SAFETY BOARD
Vehicle Recorder Division

February 20, 2020

Flight Data Recorder

Specialist's Factual Report
By Christopher Babcock

1. EVENT SUMMARY

Location: Jacksonville, Florida
Date: May 3, 2019
Aircraft: Boeing 737-800
Registration: N732MA
Operator: Miami Air International
NTSB Number: DCA19MA143

On May 3, 2019, at 2142 eastern daylight time, Miami Air International flight 293, a Boeing 737-800, registration N732MA, departed the end of the runway 10 at Jacksonville Naval Air Station, Jacksonville, Florida, and came to rest in shallow water in St. Johns River. There were no serious injuries to the 142 passengers and crew onboard. The airplane was substantially damaged. The airplane was operated by Miami Air International as a Title 14 *Code of Federal Regulations (CFR)* Part 121 supplemental non-scheduled passenger flight from Leeward Point Field, Guantanamo Bay, Cuba, to Jacksonville Naval Air Station, Jacksonville, Florida.

2. FLIGHT DATA RECORDER GROUP

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

3. FDR CARRIAGE REQUIREMENTS

The event aircraft, N732MA, was manufactured in 2001 and operating such that it was required to be equipped with an FDR that recorded, at a minimum, the 60 parameters cited in 14 *CFR* 121.344(e)(1) and 121.344(e)(3).

4. DETAILS OF FDR INVESTIGATION

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

Recorder Manufacturer/Model: **Honeywell 4700**
Recorder Serial Number: **7331**

4.1. Honeywell 4700 256 wps Description

The Honeywell 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 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 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 and its duration was approximately 2 hours and 34 minutes. The parameters evaluated for the purpose of this report appeared to be in accordance with federal FDR carriage requirements.

4.1.3. Engineering Units 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.

4.2. Time Correlation

Correlation of the FDR data from SRN to the local eastern daylight time was established by using the recorded Time GMT[2] hours, Time GMT Minutes, and Time GMT Seconds and then applying an additional 4 hours offset to convert GMT to EDT.

Accordingly, the time offset for the event flight data from SRN to local eastern daylight time is the following: EDT = SRN – 63,070 seconds. Data from the previous landing is in SRN time.

4.3. FDR Plots and Corresponding Tabular Data

Figure 1 contains a plot of basic flight data for the accident approach and landing. Figure 2 contains a plot of flight controls for the accident approach and landing. Figure 3 contains a plot of braking and thrust reverser related data for the accident approach and landing. Figure 4 contains a plot of engine and autopilot related data for the accident approach and landing.

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[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 = +.

[2] GMT is Greenwich Mean Time which is also known as Coordinated Universal Time (UTC).

Figure 5 contains a plot of flight path and weather-related data for the accident approach and landing. The time period covered in Figures 1-5 is 21:39:50 EDT through 21:42:20 EDT.

Figure 6 contains a plot of basic flight data for the previous landing. Figure 7 contains a plot of flight controls for the previous landing. Figure 8 contains a plot of braking and thrust reverser related data for the previous landing. Figure 9 contains a plot of engine and autopilot related data for the previous landing. Figure 10 contains a plot of flight path and weather related data for the previous landing. The time period covered in Figures 6-10 is SRN 88360 to 88520.

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 through 5 are provided in electronic comma separated value (*.csv) format as Attachment 1 to this report. The tabular data used to create Figures 6 through 10 are provided in electronic format as Attachment 2 to this report.

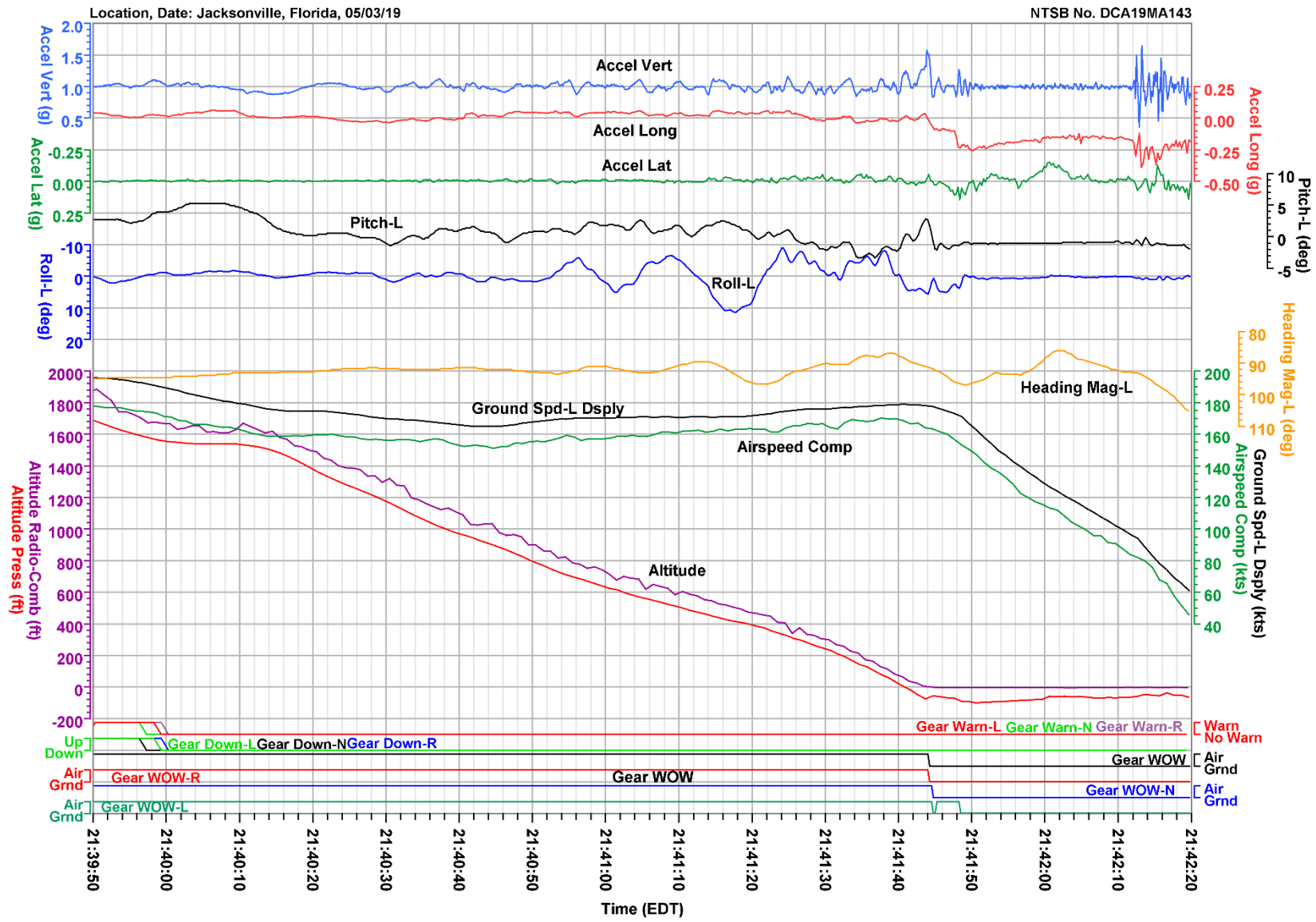

Figure 1. Plot of basic parameters during accident landing.

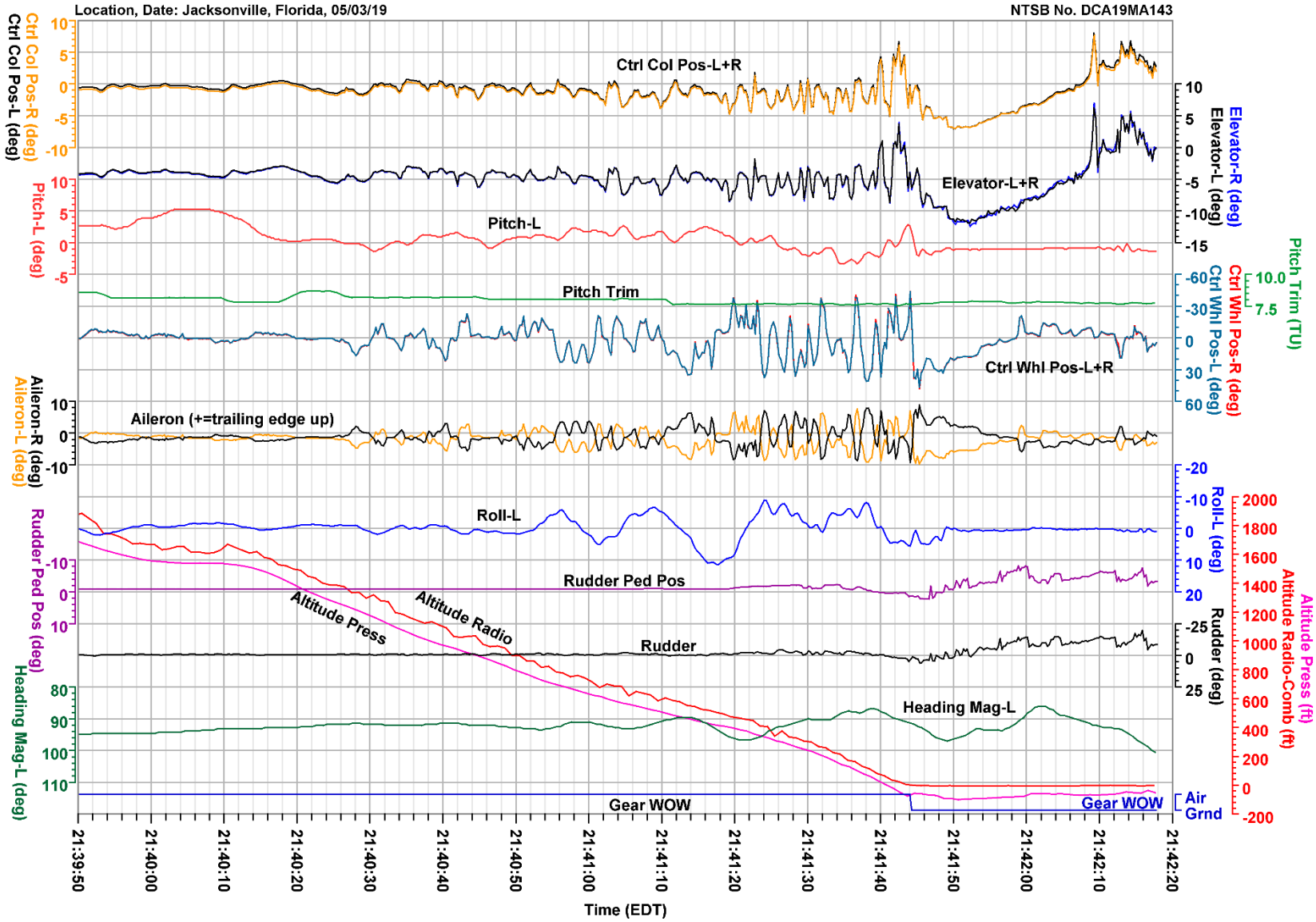

Figure 2. Plot of flight control parameters during accident landing.

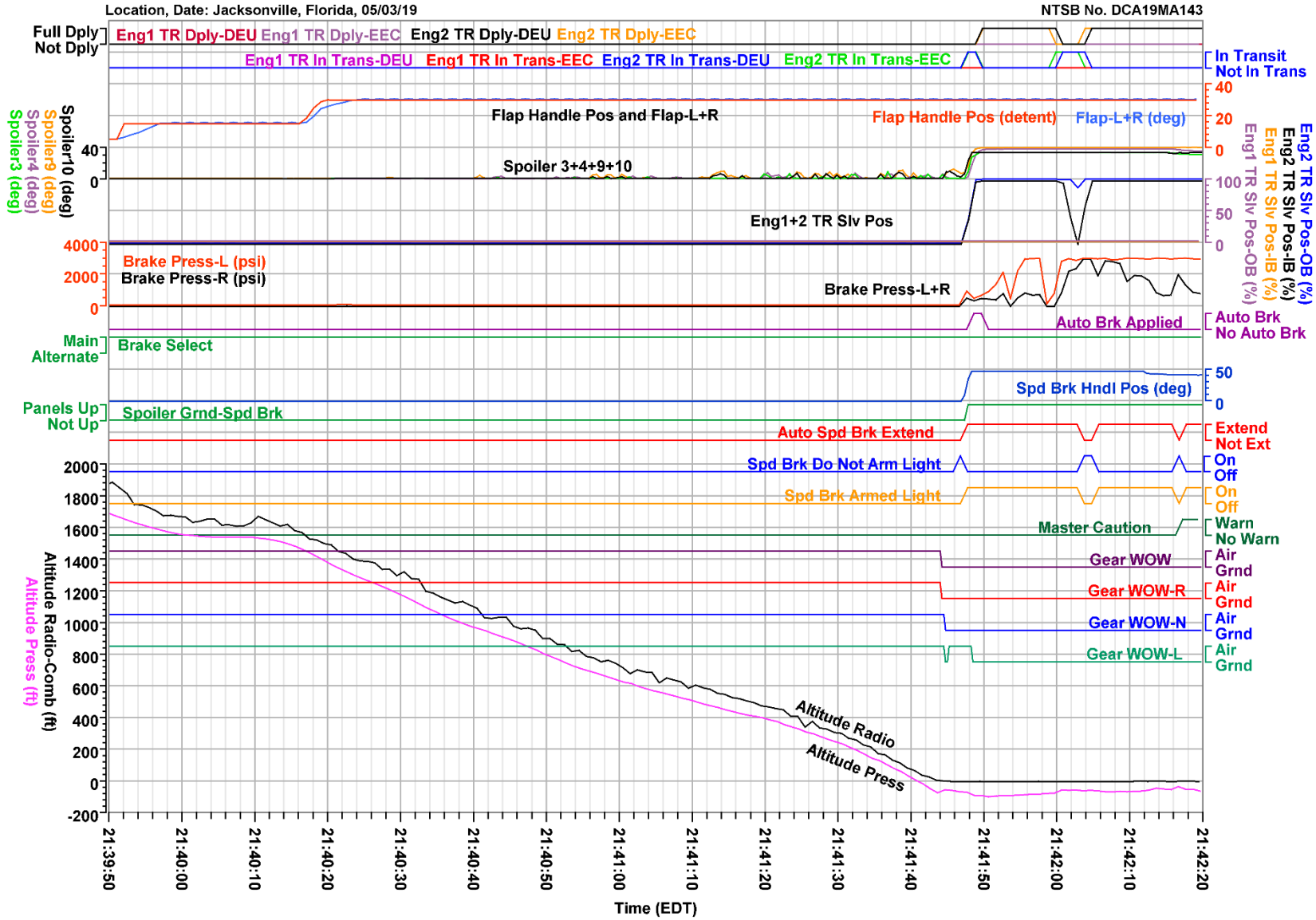

Figure 3. Plot of braking and thrust reverser parameters during accident landing.

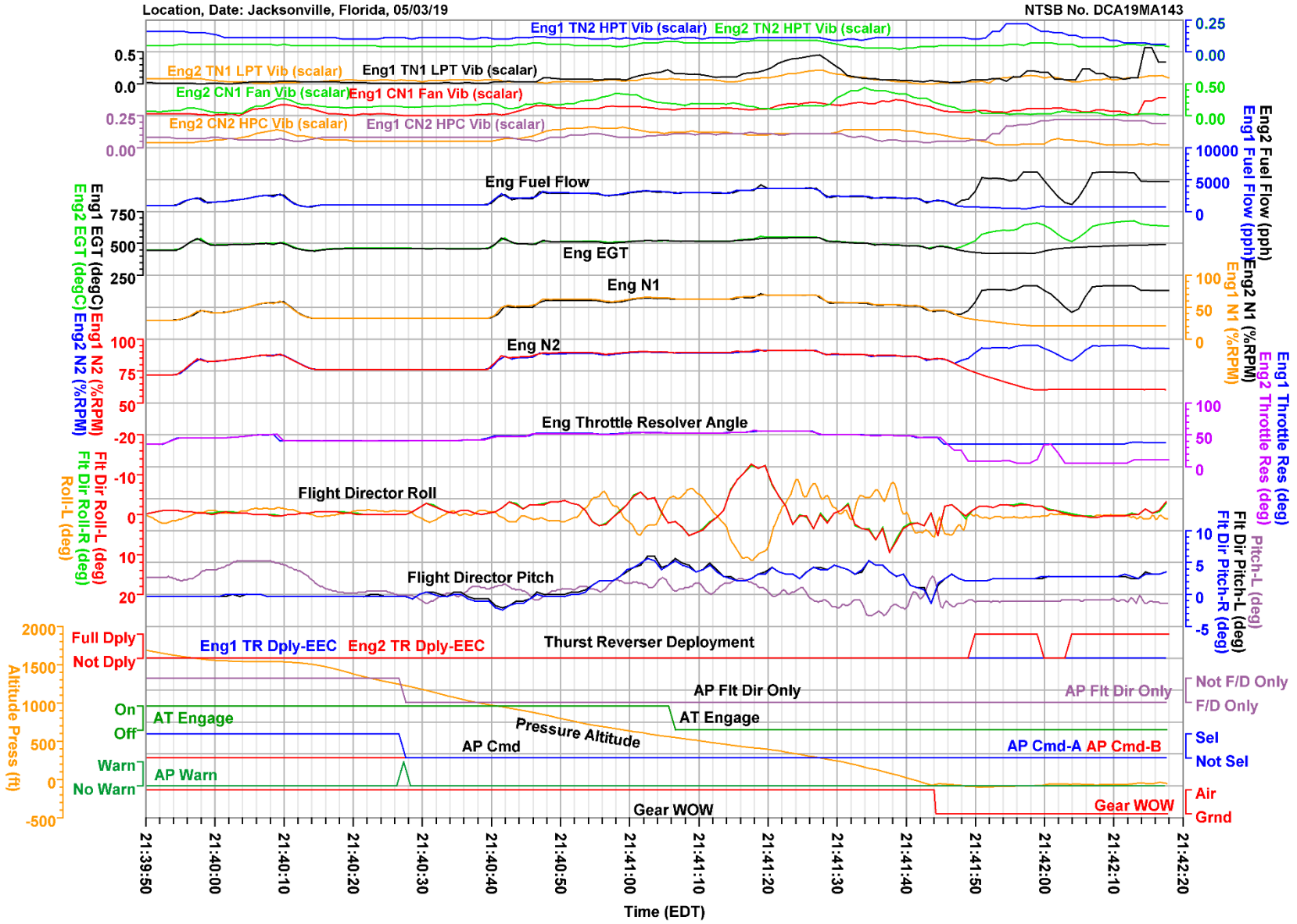

Figure 4. Plot of engine and autopilot parameters during accident landing.

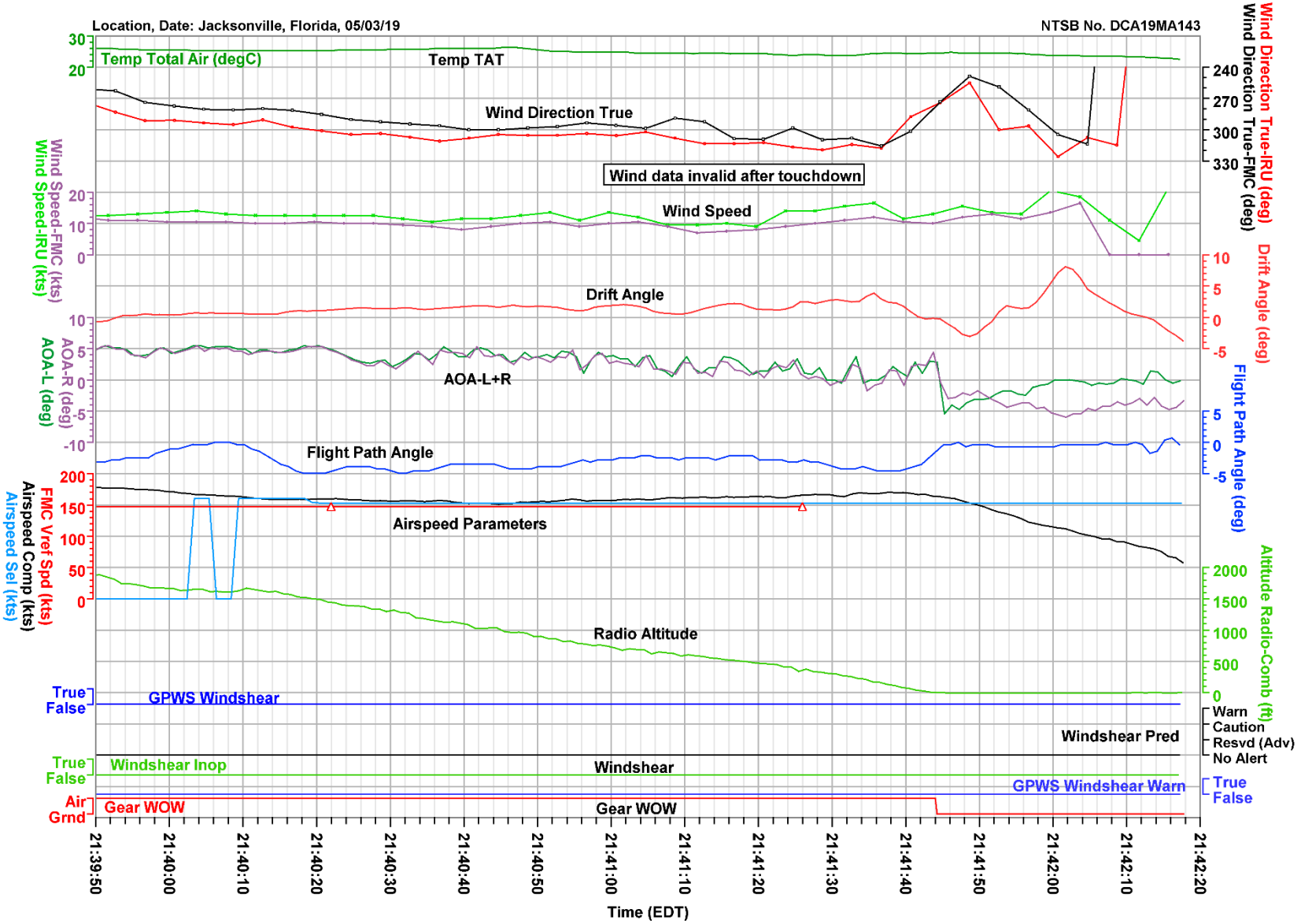

Figure 5. Plot of weather and flight path parameters during accident landing.

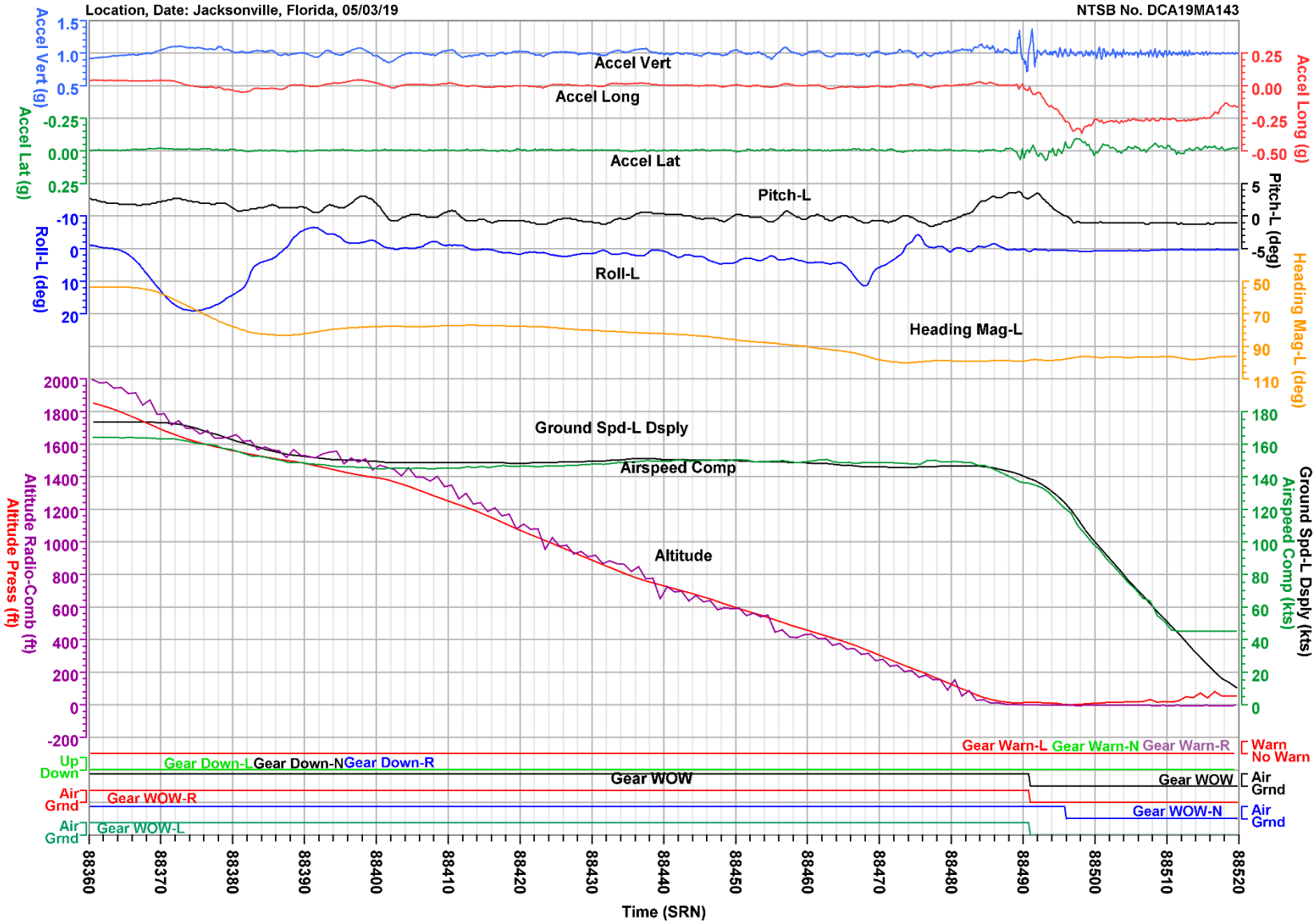

Figure 6. Plot of basic parameters during previous landing.

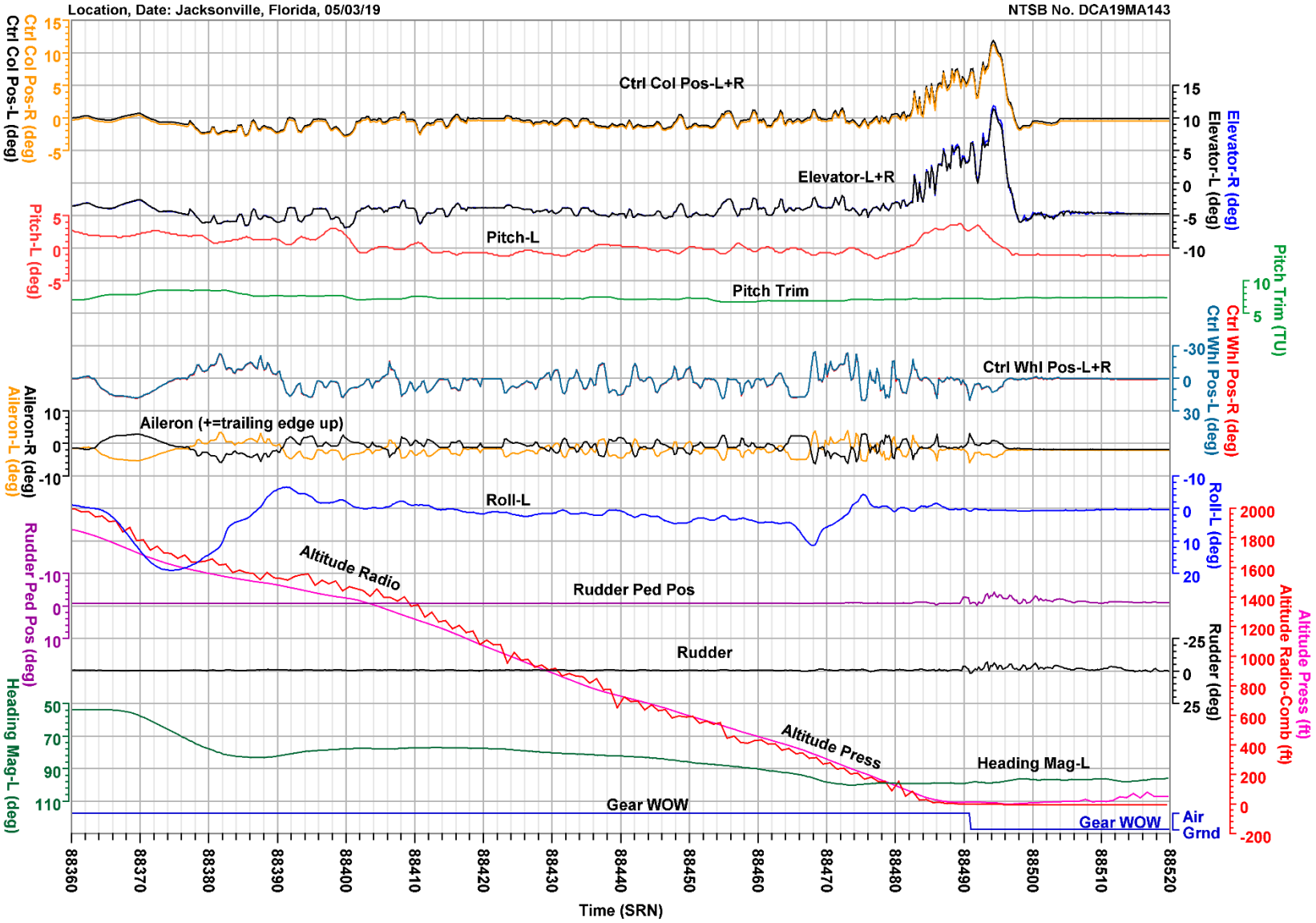

Figure 7. Plot of flight control parameters during previous landing.

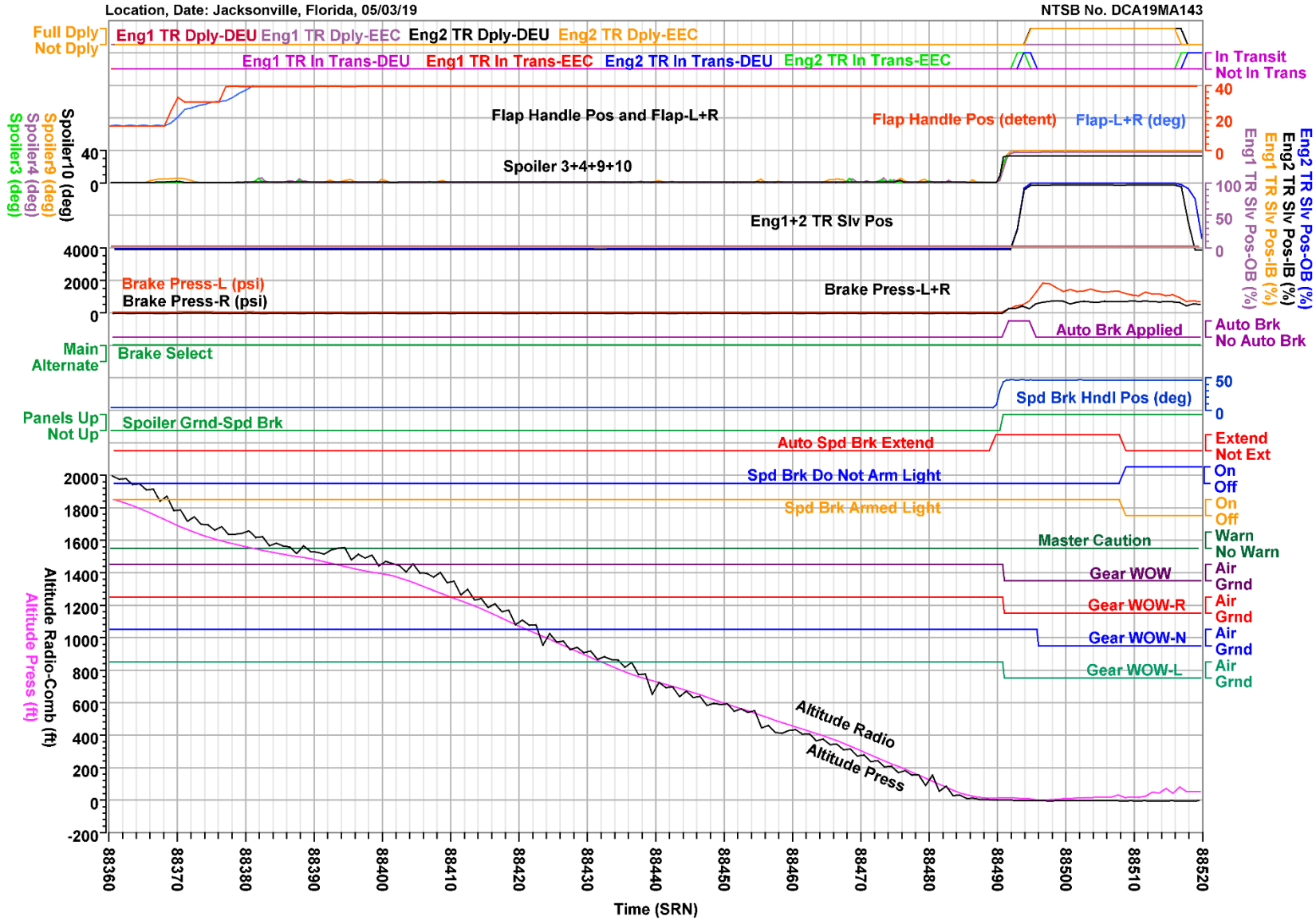

Figure 8. Plot of braking and thrust reverser parameters during accident landing.

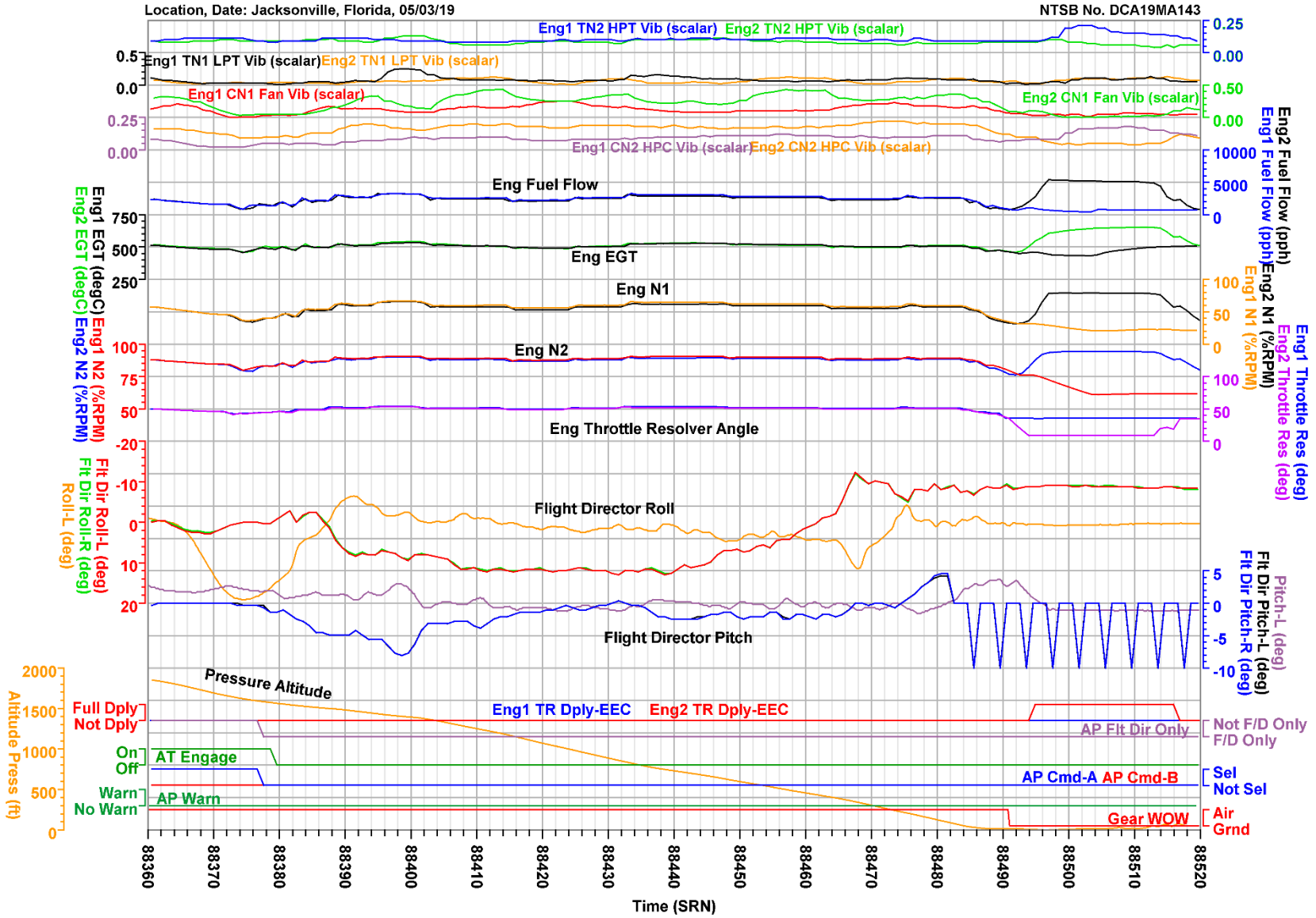

Figure 9. Plot of engine and autopilot parameters during previous landing.

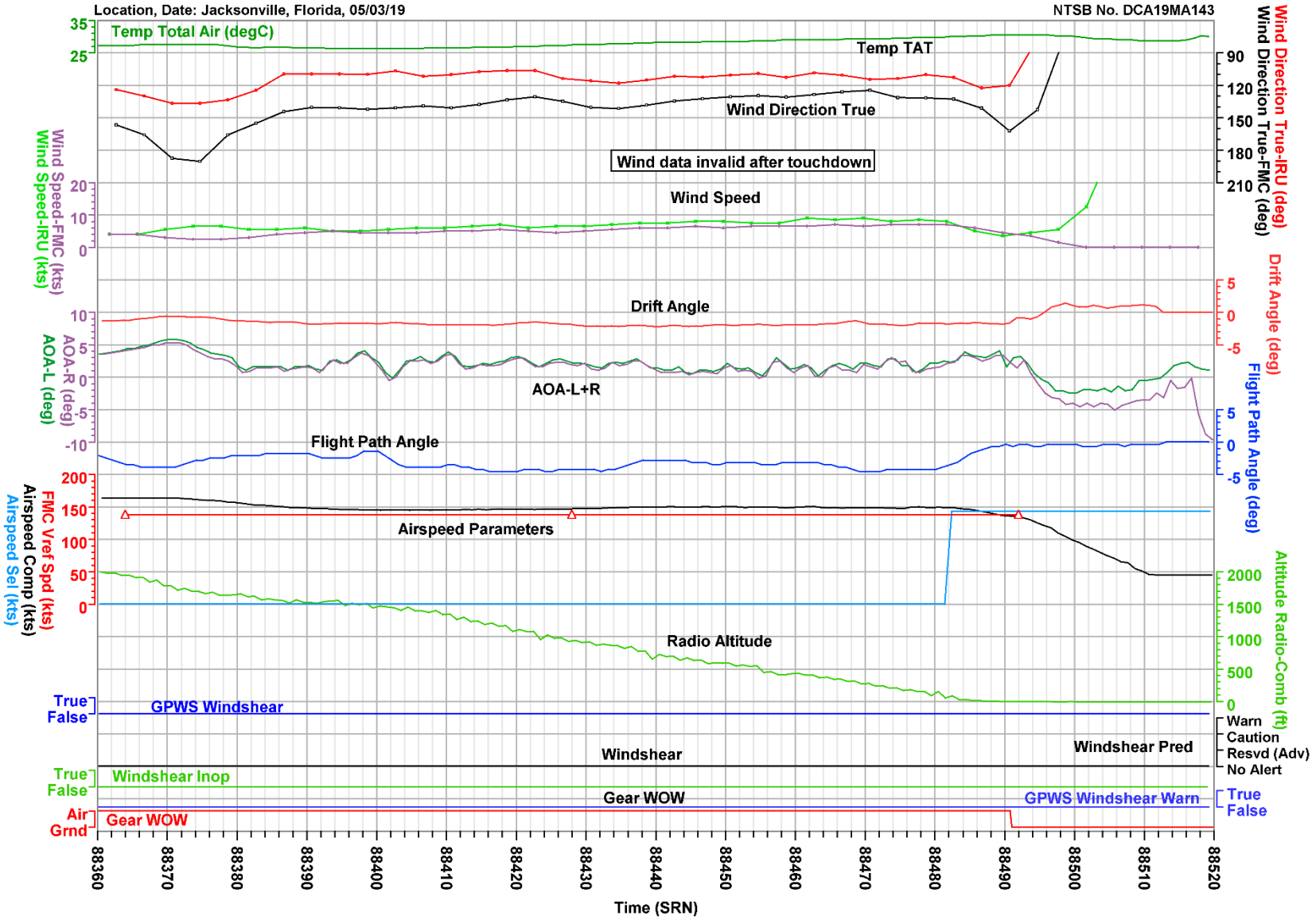

Figure 10. Plot of weather and flight path parameters during previous landing.

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 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
Accel Vert	Vertical Acceleration	g
Aileron-L	Left Aileron Position	deg
Aileron-R	Right Aileron Position	deg
Airspeed Comp	Computed Airspeed	kts
Airspeed Sel	Selected Airspeed	kts
Altitude Press	Pressure Altitude	ft
Altitude Radio Combined	Combined Radio Altitude	ft
AOA-L	Left Angle of Attack	deg
AOA-R	Right Angle of Attack	deg
AP Cmd A	Autopilot A Status	
AP Cmd B	Autopilot B Status	
AP Flt Dir Only	Autopilot/Flight Director Status	
AP Warn	Autopilot Warning	
AT Engage	Autothrottle Status	
Auto Brk Applied	Autobrake Application Status	
Auto Spd Brk Extend	Auto Speed Brake Extend Status	
Brake Select	Brake System Selection	
Brake Press-L	Left Brake Pressure	psi
Brake Press-R	Right Brake Pressure	psi
Ctrl Col Pos-L	Left Control Column Position	deg
Ctrl Col Pos-R	Right Control Column Position	deg
Ctrl Whl Pos-L	Left Control Wheel Position	deg
Ctrl Whl Pos-R	Right Control Wheel Position	deg
Drift Angle	Aircraft Drift Angle	deg
Elevator-L	Left Elevator Position	deg
Elevator-R	Right Elevator Position	deg
Eng1 CN1 Fan Vib	Engine 1 Fan Vibration	scalar
Eng1 CN2 HPC Vib	Engine 1 High Pressure Compressor Vibration	scalar
Eng1 EGT	Engine 1 Exhaust Gas Temperature	degC
Eng1 Fuel Flow	Engine 1 Fuel Flow Rate	pph
Eng1 N1	Engine 1 Fan Speed	%RPM
Eng1 N2	Engine 1 High Pressure Shaft Speed	%RPM
Eng1 Throttle Res	Engine 1 Throttle Resolver Angle	deg
Eng1 TN1 LPT Vib	Engine 1 Low Pressure Turbine Vibration	scalar
Eng1 TN2 HPT Vib	Engine 1 High Pressure Turbine Vibration	scalar
Eng1 TR Dply-DEU	Engine 1 Thrust Reverser Deployed Status DEU	
Eng1 TR Dply-EEC	Engine 1 Thrust Reverser Deployed Status EEC	
Eng1 TR In Trans-DEU	Engine 1 Thrust Reverser In Transit Status DEU	
Eng1 TR In Trans-EEC	Engine 1 Thrust Reverser In Transit Status EEC	
Eng1 TR Slv Pos-IB	Engine 1 Inboard Thrust Reverser Sleeve Position	deg
Eng1 TR Slv Pos-OB	Engine 1 Outboard Thrust Reverser Sleeve Position	deg
Eng2 CN1 Fan Vib	Engine 2 Fan Vibration	scalar
Eng2 CN2 HPC Vib	Engine 2 High Pressure Compressor Vibration	scalar

Plot/Table Labels	Parameter Names	Units
Eng2 EGT	Engine 2 Exhaust Gas Temperature	degC
Eng2 Fuel Flow	Engine 2 Fuel Flow Rate	pph
Eng2 N1	Engine 2 Fan Speed	%RPM
Eng2 N2	Engine 2 High Pressure Shaft Speed	%RPM
Eng2 Throttle Res	Engine 2 Throttle Resolver Angle	deg
Eng2 TN1 LPT Vib	Engine 2 Low Pressure Turbine Vibration	scalar
Eng2 TN2 HPT Vib	Engine 2 High Pressure Turbine Vibration	scalar
Eng2 TR Dply-DEU	Engine 2 Thrust Reverser Deployed Status DEU	
Eng2 TR Dply-EEC	Engine 2 Thrust Reverser Deployed Status EEC	
Eng2 TR In Trans-DEU	Engine 2 Thrust Reverser In Transit Status DEU	
Eng2 TR In Trans-EEC	Engine 2 Thrust Reverser In Transit Status EEC	
Eng2 TR Slv Pos-IB	Engine 2 Inboard Thrust Reverser Sleeve Position	deg
Eng2 TR Slv Pos-OB	Engine 2 Outboard Thrust Reverser Sleeve Position	deg
Flap Handle Pos	Flap Handle Position	deg
Flap-L+R	Combined Flap Position	deg
Flt Dir Pitch-L	Left Flight Director Pitch Angle	deg
Flt Dir Pitch-R	Right Flight Director Pitch Angle	deg
Flt Dir Roll-L	Left Flight Director Roll Angle	deg
Flt Dir Roll-R	Right Flight Director Roll Angle	deg
Flight Path Angle	Flight Path Angle	deg
FMC Vref Speed	Flight Management Computer Reference Speed	kts
Gear Down-L	Left Main Gear Down Discrete	
Gear Down-N	Nose Gear Down Discrete	
Gear Down-R	Right Main Gear Down Discrete	
Gear Warn-L	Left Main Gear Warning Status	
Gear Warn-N	Nose Gear Warning Status	
Gear Warn-R	Right Main Gear Warning Status	
Gear WOW	Combined Landing Gear Weight on Wheels	
Gear WOW-L	Left Main Landing Gear Weight on Wheels	
Gear WOW-N	Nose Gear Weight on Wheels	
Gear WOW-R	Right Main Landing Gear Weight on Wheels	
GPWS Windshear	Ground Proximity Warning System Windshear Status	
GPWS Windshear Warn	GPWS Windshear Warning Status	
Ground Spd-L Dsply	Ground Speed Displayed	kts
Heading Mag-L	Left Magnetic Heading	deg
Key VHF-1	Microphone Keying-1	
Key VHF-2	Microphone Keying-2	
Latitude	Latitude Position	deg
Longitude	Longitude Position	deg
Master Caution	Master Caution	
Pitch-L	Left Pitch Angle	deg
Pitch Trim	Pitch Trim Position	TU
Roll-L	Left Roll Angle	deg
Rudder	Rudder Position	deg
Rudder Ped Pos	Rudder Pedal Position	deg
Spd Brk Armed Light	Speed Brake Armed Light Status	
Spd Brk Do Not Ram Light	Speed Brake Do Not Arm Light Status	
Spd Brk Hndl Pos	Speed Brake Handle Position	deg
Spoiler Grnd-Spd Brk	Ground Spoiler/Speed Brake Panel Status	
Stabilizer Pos	Stabilizer Position	deg
Spoiler3	Spoiler 3 Position	deg
Spoiler4	Spoiler 4 Position	deg
Spoiler9	Spoiler 9 Position	deg
Spoiler10	Spoiler 10 Position	deg

Plot/Table Labels	Parameter Names	Units
Temp Total Air	Total Air Temperature	degC
Time Clock GMT Hrs	Greenwich Mean Time Hours	hrs
Time Clock GMT Min	Greenwich Mean Time Minutes	min
Time Clock GMT Sec	Greenwich Mean Time Seconds	sec
Total Air Temp	Total Air Temperature	degC
Wind Direction True – FMC	Flight Management Computer Wind Direction	deg
Wind Direction True – IRU	Inertial Reference Unit Wind Direction	deg
Windshear Pred	Predictive Windshear Warning Status	
Windshear Inop	Windshear Warning Inoperative Status	
Wind Speed – FMC	Flight Management Computer Wind Speed	kts
Wind Speed – IRU	Inertial Reference Unit Wind Speed	kts

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 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.

Table A-2. Unit abbreviations.

Unit Abbreviations	Descriptions
deg	degrees
kts	knots
g	g
degC	degrees Celsius
in	inches
ft	feet
hrs	hours
min	minutes
sec	seconds
pph	pounds per hour
psi	pounds per square inch
TU	trim units
%rpm	percent revolutions per minute