

NATIONAL TRANSPORTATION SAFETY BOARD
Vehicle Recorder Division
Washington, D.C. 20594

July 10, 2020

Flight Data Recorder

Specialist's Factual Report
By Charles Cates

1. EVENT SUMMARY

Location: Big Grand Cay, Bahamas
Date: July 04, 2019
Aircraft: Agusta AW139
Registration: N32CC
Operator: Challenger Management, LLC
NTSB Number: ERA19FA210

On July 4, 2019, about 0153 eastern daylight time, an Agusta AW139, N32CC, owned and operated by Challenger Management LLC, was substantially damaged when it impacted the Atlantic Ocean near Big Grand Cay, Abaco, Bahamas. The commercial pilot, airline transport pilot rated copilot, and five passengers were fatally injured. The helicopter was being operated under the provisions of Title 14 *Code of Federal Regulations* Part 91 as a personal flight. Night visual meteorological conditions prevailed at the time and an instrument flight rules flight plan was filed for a flight from Walker's Cay Airport (MYAW), Walker's Cay, Bahamas, to Fort Lauderdale/Hollywood International Airport (FLL), Fort Lauderdale, Florida. The flight departed from a concrete pad at Big Grand Cay, which was located about 5 nautical miles (nm) southeast from MYAW, about 1 minute prior to the accident.

2. FLIGHT DATA RECORDER GROUP

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

3. FDR CARRIAGE REQUIREMENTS

The event aircraft, N32CC, was manufactured in 2008, and was operating such that it was required to be equipped with an FDR that recorded, at a minimum, 23 parameters, as cited in 14 CFR Part 91.609(c) Appendix F.

4. DETAILS OF FDR INVESTIGATION

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

Recorder Manufacturer/Model: **Penny & Giles MPFR**
Recorder Serial Number: **272004-001**

4.1. Penny & Giles MPFR Description

The Penny & Giles Multi-Purpose Flight Recorder (MPFR) is a compact combination FDR and CVR used in some rotary wing and small to medium aircraft that records airplane flight information in a digital format using solid-state flash memory as the recording medium. The MPFR can receive data in the ARINC 573/717 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 MPFR is designed to meet the and packaging requirements of TSO-C124b.

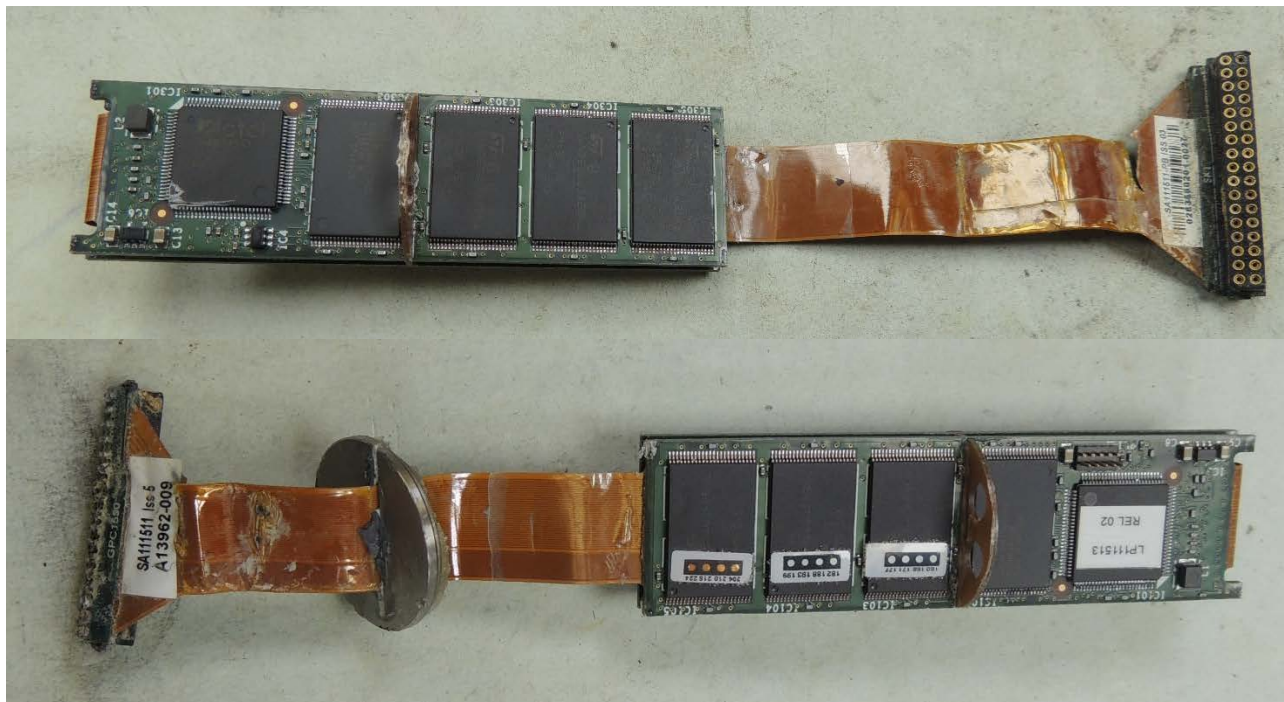
4.1.1. Recorder Condition

The recorder was damaged by impact forces and was submerged in sea water. The as-received condition of the recorder is shown in figure 1. The recorder was disassembled, cleaned, dried, and inspected. There was no evidence of internal damage or corrosion on the memory module. The extraction of the memory module is shown in figure 2. The memory module was read out without difficulty using hardware and software from the recorder manufacturer.

Figure 1. Damaged exterior of flight recorder.



Figure 2. Both sides of memory module extracted from the recorder.



4.1.2. Recording Description

The FDR recording contained approximately 25.5 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 1 minute and 30 seconds. The parameters evaluated for the purpose of this report appeared to be in accordance with federal FDR carriage requirements.

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.

4.2. Time Correlation

Correlation of the FDR data from SRN to the event local time, eastern daylight time (EDT), was established by using the recorded Time GMT² hours, Time GMT Minutes, and Time

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).

GMT Seconds and then applying an additional -4 hours offset to change GMT to EDT. Accordingly, the time offset for the event flight data from SRN to local EDT is the following:

$$\text{EDT} = \text{SRN} - 85,216$$

Therefore, for the rest of this report, all times for the accident flight and the immediately preceding flight from West Palm Beach airport (PBI) to Big Grand Cay are referenced as EDT, not SRN. However, previous landings provided in tabular format only are referenced as SRN, not local time.

4.3. FDR Plots and Corresponding Tabular Data

Figures 3-8 contain FDR data recorded during the event on July 4, 2019. Figures 9 and 10 contain FDR data recorded during the inbound (previous) flight, also on July 4, 2019. All the parameters listed in table A-1 are plotted except Time GMT Hours, Time GMT Minutes, and Time GMT Seconds.

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.

Figures 3-8 cover a time span of 1 minute 30 seconds, from 1:52:00 am to 1:53:30 am. Figure 3 contains aircraft basic parameters, figure 4 contains parameters relating to aircraft flight controls, figure 5 contains engine parameters, figure 6 is of autoflight-related parameters, figure 7 is an annotated overview of the accident sequence, and figure 8 is a map overlay from Google Earth of the accident flight. Note that Google Earth imagery is not representative of the atmospheric and lighting conditions at the time of the flight.

Figures 9-10 are data from the inbound flight to Big Grand Cay from 12:54:00 am to 1:43:00 am. Figure 9 contains aircraft basic parameters and figure 10 is a map overlay from Google Earth.

The data show that the helicopter flew from West Palm Beach, FL, departing at 12:55 am on the morning of July 4, 2019. The helicopter flew east over the Atlantic Ocean at 2,640 ft pressure altitude and 140 knots indicated airspeed. The flight lasted for about 47 minutes and landed at Big Grand Cay at 1:42 am. The engines were idled and the helicopter stayed on the ground at Big Grand Cay for 10 minutes.

At 1:52:17 am, the weight on wheels (WOW) signal transitioned to false and altitude and vertical speed began to increase. The autopilot was not engaged, the lateral and longitudinal cyclic force trim releases (FTR) were engaged and remained engaged for the entire flight, and the collective FTR was engaged for the first 9 seconds, until the collective stabilized at around 70%. Engine speeds, temperatures, and torque output were matched and the helicopter power index was controlling to engine torque.

At 1:52:32 am, about 15 seconds after the WOW transition, the helicopter was at about 75 ft above ground level (AGL) and climbing, ground speed began to increase, and climb rate stabilized at about 600 feet per minute (fpm). The aircraft pitch decreased about 5 seconds later and became negative, reaching more than 13 degrees nose down at 1:52:43. Also at

this time the climb rate began to decrease and became negative. As the aircraft began to descend from a peak of 190 ft AGL, an EGPWS Terrain Awareness alert was recorded at 1:52:48. Two seconds later the autopilot was engaged.

Upon engagement at 1:52:50, the autopilot was active in indicated airspeed hold and heading select longitudinal and lateral modes, however the FTR was active on the cyclic meaning that the pilot was manually commanding cyclic movement. The collective was engaged in the Altitude Acquire autopilot vertical mode with a previously selected altitude target of 1,000 ft and a climb rate target of 1,000 fpm. However, the collective FTR was momentarily engaged (one sample was recorded on channel 2 of the flight control system) immediately after the autopilot, and the climb rate target shifted to 100 fpm. It is not possible to determine from which side of the flight deck (pilot or copilot) the collective FTR signal originated.

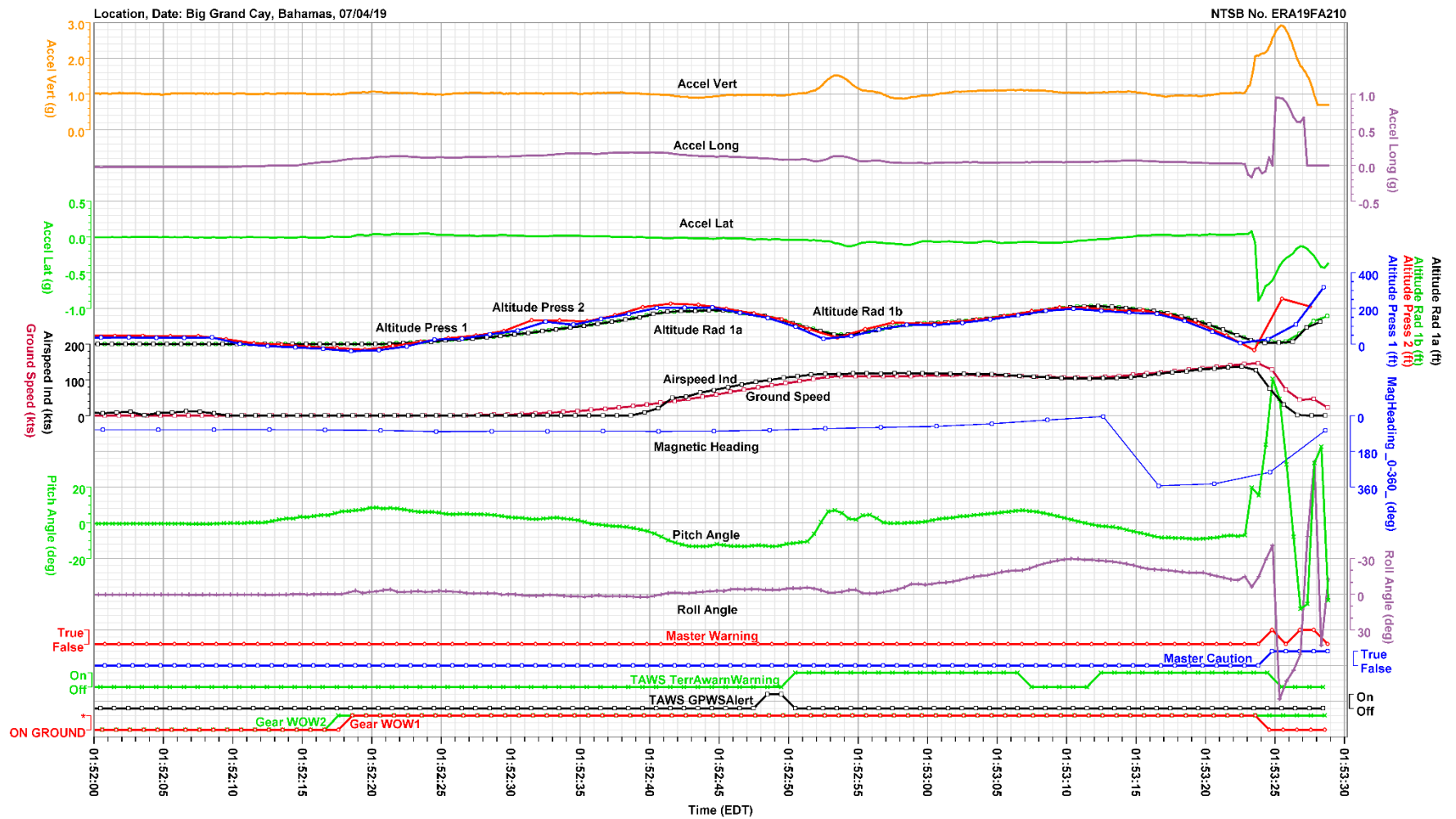
At 1:52:51, following engagement of the autopilot, longitudinal cyclic excursions were recorded up to 30% in 1.5 seconds. Aircraft pitch varied from -11 to +7 to 0 degrees, vertical speed rapidly increased, and the helicopter began to climb again after reaching a minimum altitude of 52 ft AGL. The helicopter also entered a left roll at this time, however the lateral cyclic remained centered with no significant change.

At 1:52:53, the collective began to decrease as the altitude climbed at a rate greater than the climb rate target of 100 fpm and left roll continued to increase. Collective continued to decrease to a minimum value of 43.8% as the helicopter climbed, when climb rate and aircraft pitch began decreasing and became negative from a peak altitude of 212 ft AGL at 1:53:11. The aircraft EGPWS sounded another series of Terrain Awareness alerts in response to the descent which continued until impact with the water, and the collective began to increase at a rate of 5% per second.

The helicopter continued to descend, reaching a peak rate of descent of 1,760 fpm 2 seconds prior to impact. At the final point prior to impact with the water at 1:53:24, the helicopter attitude was 7 deg nose down pitch and 11.7 deg left roll with a recorded rate of descent of 1,280 fpm.

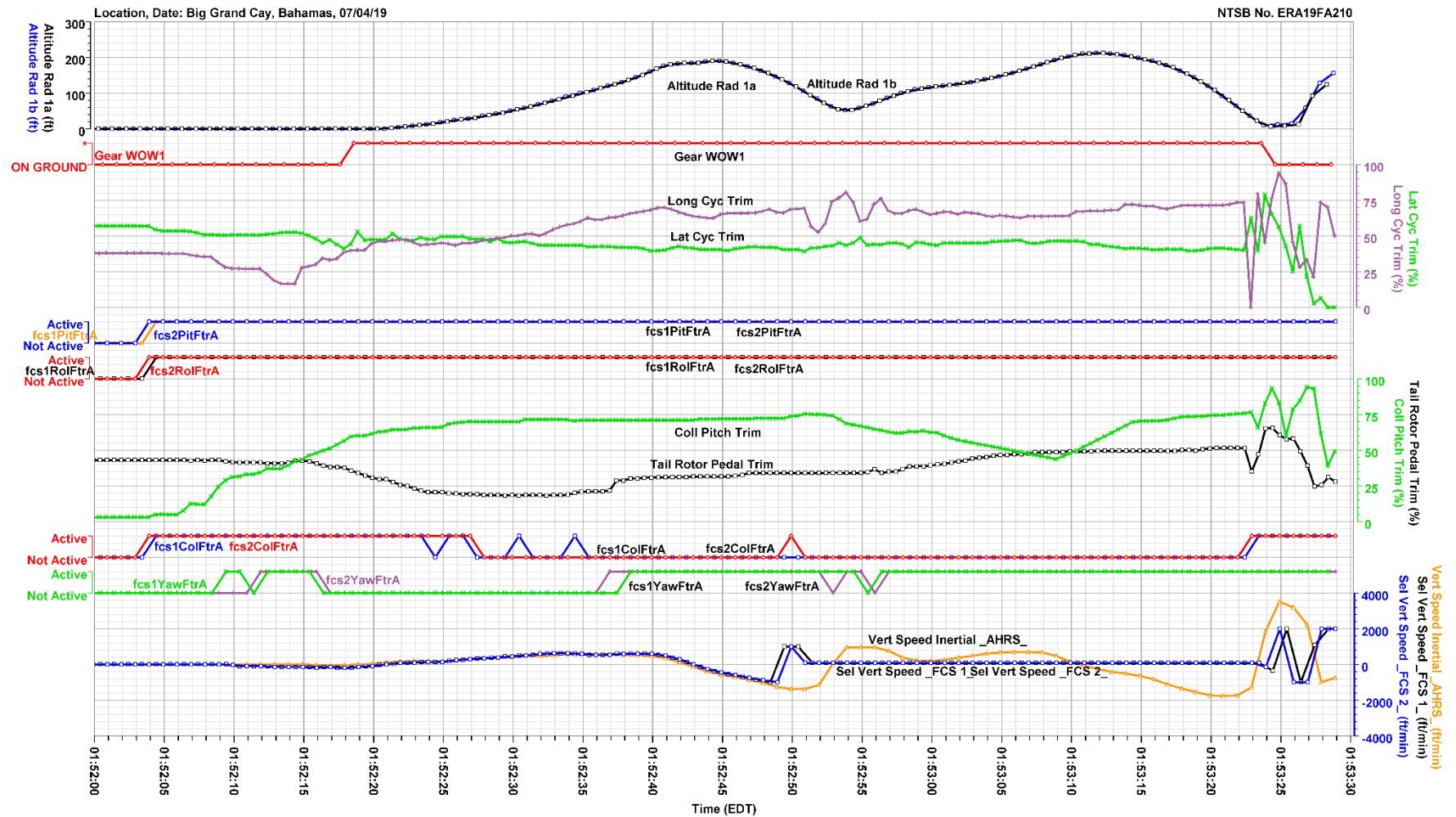
The corresponding tabular data used to create figures 3 to 10, including Time GMT Hours, Time GMT Minutes, and Time GMT Seconds, are provided in electronic comma separated value (*.csv) format as attachment 1 to this report.

Figure 3. Plot of aircraft basic parameters during entire flight.



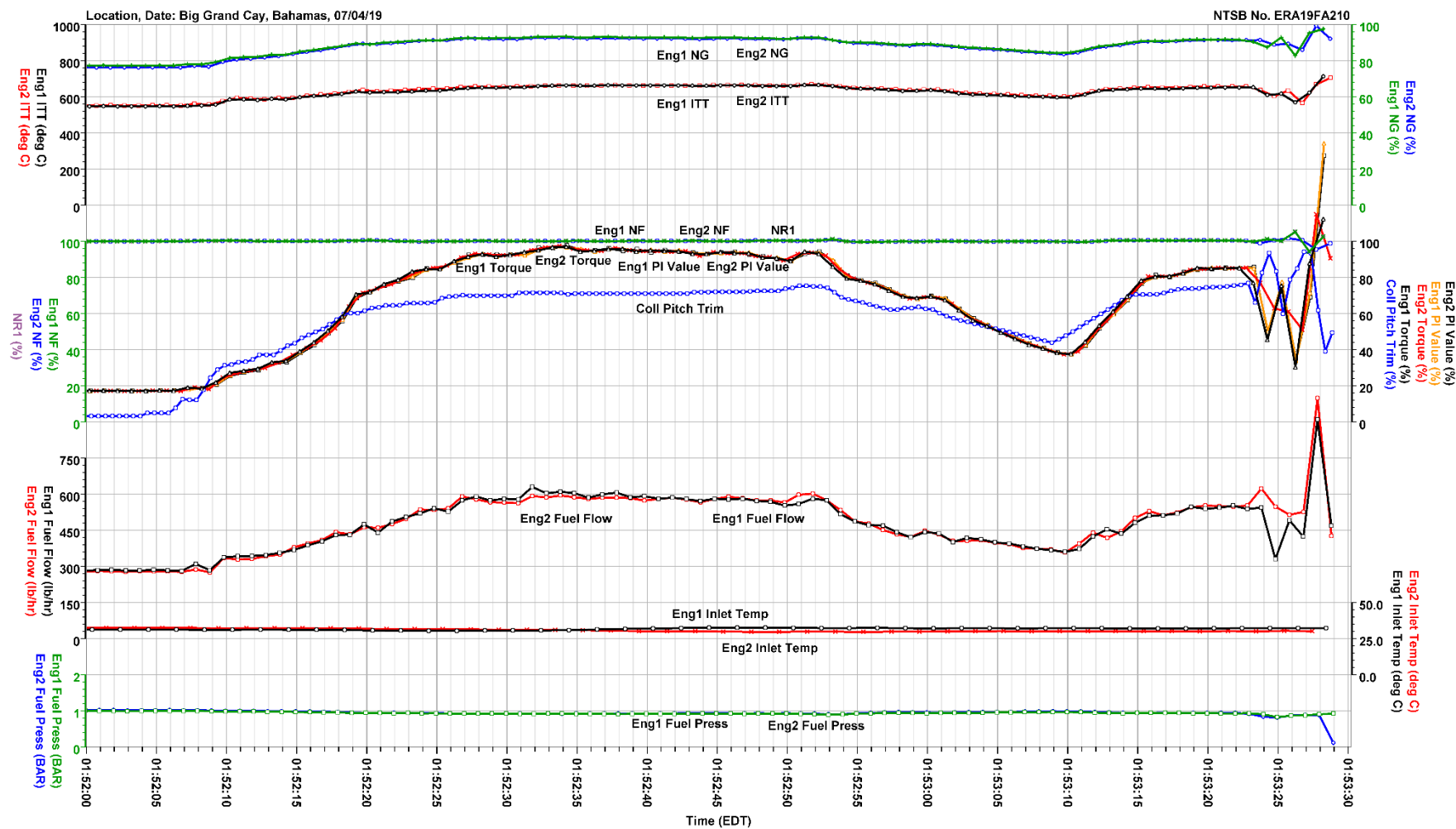
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Figure 4. Plot of flight controls parameters during entire flight.



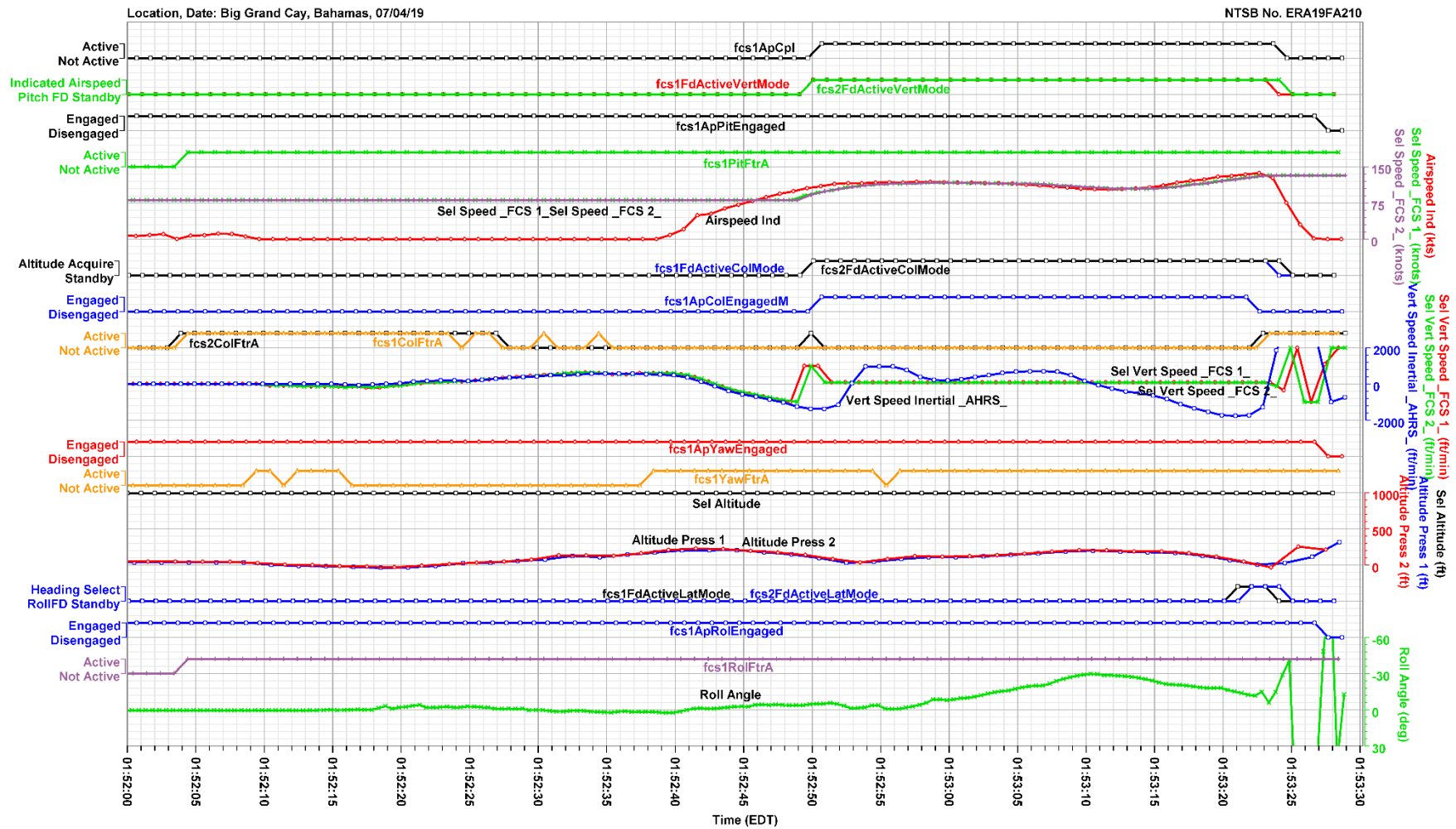
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Figure 5. Plot of engine parameters during entire flight.



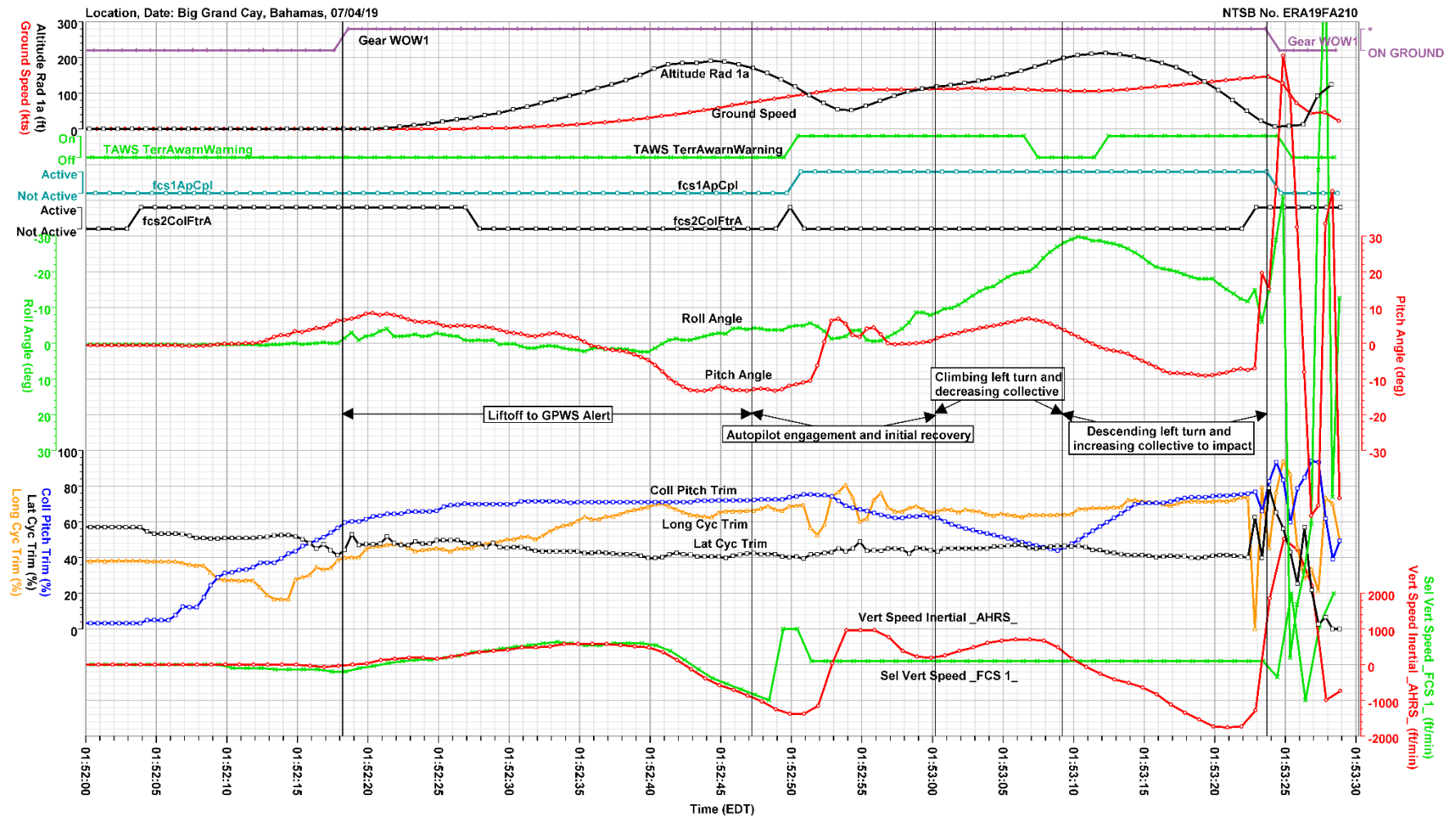
National Transportation Safety Board

Figure 6. Plot of autoflight parameters during entire flight.



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Figure 7. Full flight and accident sequence annotated with significant points in the sequence.

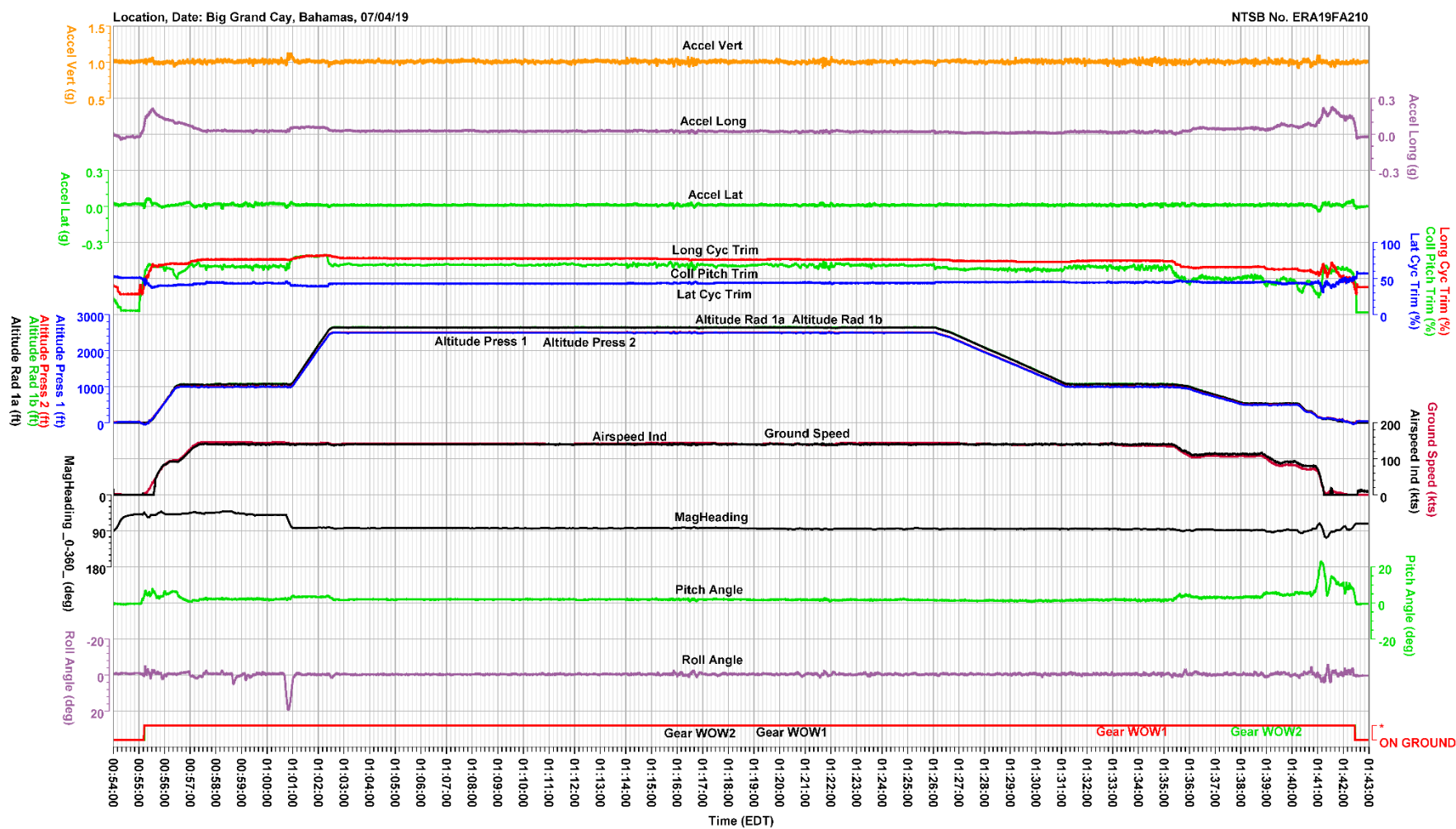


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Figure 8. Map overlay of FDR recorded latitude and longitude of accident flight.



Figure 9. Basic flight data from inbound (previous) flight.



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Figure 10. Map overlay of FDR recorded latitude and longitude from inbound (previous) flight.



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	Description	Units
1. Accel Lat	Lateral Acceleration	g
2. Accel Long	Longitudinal Acceleration	g
3. Accel Vert	Vertical Acceleration	g
4. Airspeed Ind	Indicated Airspeed	kts
5. Altitude Press 1	Pressure Altitude 1	ft
6. Altitude Press 2	Pressure Altitude 2	ft
7. Altitude Rad 1a	Radio Altitude 1	ft
8. Altitude Rad 1b	Radio Altitude 2	ft
9. Coll Pitch Trim	Collective Pitch Position	%
10. Eng1 Fuel Flow	Engine 1 Fuel Flow	pph
11. Eng1 Fuel Press	Engine 1 Fuel Pressure	bar
12. Eng1 Inlet Temp	Engine 1 Inlet Temperature	deg C
13. Eng1 ITT	Engine 1 Inter-Turbine Temperature	deg C
14. Eng1 NF	Engine 1 Free Turbine Speed	%
15. Eng1 NG	Engine 1 Gas Generator Speed	%
16. Eng1 PI Parameter	Engine 1 Power Index Parameter	
17. Eng1 PI Value	Engine 1 Power Index Value	%
18. Eng1 Torque	Engine 1 Torque	%
19. Eng2 Fuel Flow	Engine 2 Fuel Flow	pph
20. Eng2 Fuel Press	Engine 2 Fuel Pressure	bar
21. Eng2 Inlet Temp	Engine 2 Inlet Temperature	deg C
22. Eng2 ITT	Engine 2 Inter-Turbine Temperature	deg C
23. Eng2 NF	Engine 2 Free Turbine Speed	%
24. Eng2 NG	Engine 2 Gas Generator Speed	%
25. Eng2 PI Parameter	Engine 2 Power Index Parameter	
26. Eng2 PI Value	Engine 2 Power Index Value	%
27. Eng2 Torque	Engine 2 Torque	%
28. fcs1ApColEngagedM	Autopilot Collective Mode Engaged - fcs1	
29. fcs1ApCpl	Autopilot Coupled - fcs1	
30. fcs1ColFtrA	Collective Force Trim Release - fcs1	
31. fcs1FdActiveColMode	Flight Director Active Collective Mode - fcs1	
32. fcs1FdActiveLatMode	Flight Director Active Lateral Mode - fcs1	
33. fcs1FdActiveVertMode	Flight Director Active Vertical Mode - fcs1	
34. fcs1PitFtrA	Longitudinal Cyclic Force Trim Release - fcs1	
35. fcs1RolFtrA	Lateral Cyclic Force Trim Release - fcs1	
36. fcs1YawFtrA	Tail Rotor Pedal Force Trim Release - fcs1	

Plot/Table Labels	Description	Units
37. fcs2ApCpl	Autopilot Coupled - fcs2	
38. fcs2ColFtrA	Collective Force Trim Release - fcs2	
39. fcs2FdActiveColMode	Flight Director Active Collective Mode - fcs2	
40. fcs2FdActiveLatMode	Flight Director Active Lateral Mode - fcs2	
41. fcs2FdActiveVertMode	Flight Director Active Vertical Mode - fcs2	
42. fcs2PitFtrA	Longitudinal Cyclic Force Trim Release - fcs2	
43. fcs2RolFtrA	Lateral Cyclic Force Trim Release - fcs2	
44. fcs2YawFtrA	Tail Rotor Pedal Force Trim Release - fcs2	
45. Gear WOW1	Weight on Wheels sensor 1	
46. Gear WOW2	Weight on Wheels sensor 2	
47. Ground Speed	Ground speed	kts
48. Lat Cyc Trim	Lateral Cyclic Position	%
49. Latitude	Latitude	deg
50. Long Cyc Trim	Longitudinal Cyclic Position	%
51. Longitude	Longitude	deg
52. MagHeading _0-360_	Magnetic Heading	deg
53. Master Caution	Master Caution	
54. Master Warning	Master Warning	
55. NR1	Main Rotor Speed	%
56. Pitch Angle	Aircraft Pitch	deg
57. Roll Angle	Aircraft Roll	deg
58. Sel Altitude	Selected Altitude	ft
59. Sel Speed _FCS 1_	Selected Speed - fcs1	knots
60. Sel Speed _FCS 2_	Selected Speed - fcs2	knots
61. Sel Vert Speed _FCS 1_	Selected Vertical Speed - fcs1	ft/min
62. Sel Vert Speed _FCS 2_	Selected Vertical Speed - fcs2	ft/min
63. Tail Rotor Pedal Trim	Tail Rotor Pedal Position	%
64. TAWS GPWSAlert	Ground Proximity Warning System Alert	
65. TAWS TerrAwarWarn	Terrain Awareness Warning System Warning	
66. Vert Speed Inertial _AHRS_	Inertial Vertical Speed	ft/min
67. Yaw Rate	Yaw Rate	deg/sec

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 and discrete abbreviations.

Unit and Discrete Abbreviation	Description
kts	knots
ft	feet
pph (lb/hr)	pounds per hour
deg C	degrees Celsius
deg	degrees
ft/min	feet per minute
deg/sec	degrees per second
EGPWS	Enhanced Ground Proximity Warning System
TAWS	Terrain Awareness Warning System
FTR	Force Trim Release
FD	Flight Director
fpm	feet per minute