Docket No. SA-538

**Exhibit Nos. 10-A,
10-B**

NATIONAL TRANSPORTATION SAFETY BOARD

Washington, D.C.

Flight Data Recorder

Group Chairman's Factual Report

(36 Pages)

Exhibit 10-A FDR Group Chairman's Factual Report
Exhibit 10-B Attachment 1 – CSV Data From FDR

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

January 29, 2014

Flight Data Recorder - 10

Group Chairman's Factual Report
By Greg Smith

1. EVENT SUMMARY

Location: Birmingham, Alabama
Date: August 14, 2013
Aircraft: Airbus A300-600
Registration: N155UP
Operator: UPS
NTSB Number: DCA13MA133

On August, 14, 2013, at about 0447 central daylight time (CDT), United Parcel Service (UPS) flight 1354, an Airbus A300-600, N155UP, crashed short of runway 18 while on approach to Birmingham-Shuttlesworth International Airport (BHM), Birmingham, Alabama. The captain and first officer were fatally injured and the airplane was destroyed. The scheduled cargo flight was operating under the provisions of 14 Code of Federal Regulations (CFR) Part 121 and originated from Louisville International-Standiford Field Airport (SDF), Louisville, Kentucky.

2. FLIGHT DATA RECORDER GROUP

A flight data recorder (FDR) group was convened on August 16, 2013

Chairman: Greg Smith
Aerospace Engineer, Vehicle Recorders Division
NTSB

Member: George Haralampopoulos
Aerospace Engineer, Vehicle Recorders Division
NTSB

Member: John Koza
Investigator, Flight Safety Office
Pratt & Whitney

Member: Michael Lankford
FOQA Supervisor, Flight Training
UPS Airlines

Member: James McLeroy
Aircraft Engineer, Avionics Systems
UPS Airlines

Member: Capt. Craig Hoskins
Vice President, Safety & Technical Affairs
Airbus Americas, Inc

Member: Albert Urdiroz
Director of Flight Safety/Accident Investigator
Airbus

Member: Stuart Lau
Safety Specialist, Accident Investigation Committee
Independent Pilots Association (IPA)

Member: Stephane Pion
FDR Specialist, Engineering Department
Bureau d'Enquêtes et d'Analyses (BEA)

Member: Anna Cushman
Flight Data Lab Manager, Accident Investigation Division
Federal Aviation Administration (FAA)

Member: Nathan Rohrbaugh
Flight Data Analyst, Accident Investigation Division
Federal Aviation Administration (FAA)

3. FDR Carriage Requirements

The event aircraft, N155UP, was manufactured in November 2003, and was operating such that it was required to be equipped with an FDR that recorded, at a minimum, 88 parameters, as cited in Title 14 *Code of Federal Regulations* Part 121.344.

4. DETAILS OF FLIGHT DATA RECORDER INVESTIGATION

The Safety Board's Vehicle Recorder Division received the following FDR:

Recorder Manufacturer/Model: **L-3/Fairchild FA2100 256 wps**
Recorder Serial Number: **unknown**

4.1. Recorder/Installation Information

4.1.1. L-3/Fairchild FA2100 256 wps Description

This model FDR records airplane flight information in a digital format using solid-state flash memory as the recording medium. The FA2100 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 FA2100 is designed to meet the crash-survivability requirements of TSO-C124a.

4.1.2. Recorder Power sources

The FDR Group reviewed the power sources for the FDR, Digital Flight Data Acquisition Management Unit (DFDAMU), and the CVR. The FDR and DFDAMU were powered by the essential AC bus. The CVR was powered by the emergency bus. The essential AC bus can be powered by any generator (gen 1, gen 2, APU gen) and is not backed up by aircraft batteries. The emergency bus is backed up by aircraft batteries which would account for the CVR continuing to record after the FDR lost power.

4.1.3. Recorder Condition

The recorder was damaged in the event. The extent of the damage is shown in figures 1 through 3 below. The extraction of the memory module is shown in figures 4 through 8 below. The circuit boards inside the memory module were undamaged. A new interface cable and connector were attached to the circuit boards and the memory was downloaded by attaching it to a functional chassis and following the standard procedures for downloading an undamaged recorder.

Figure 1. FDR - Left Side

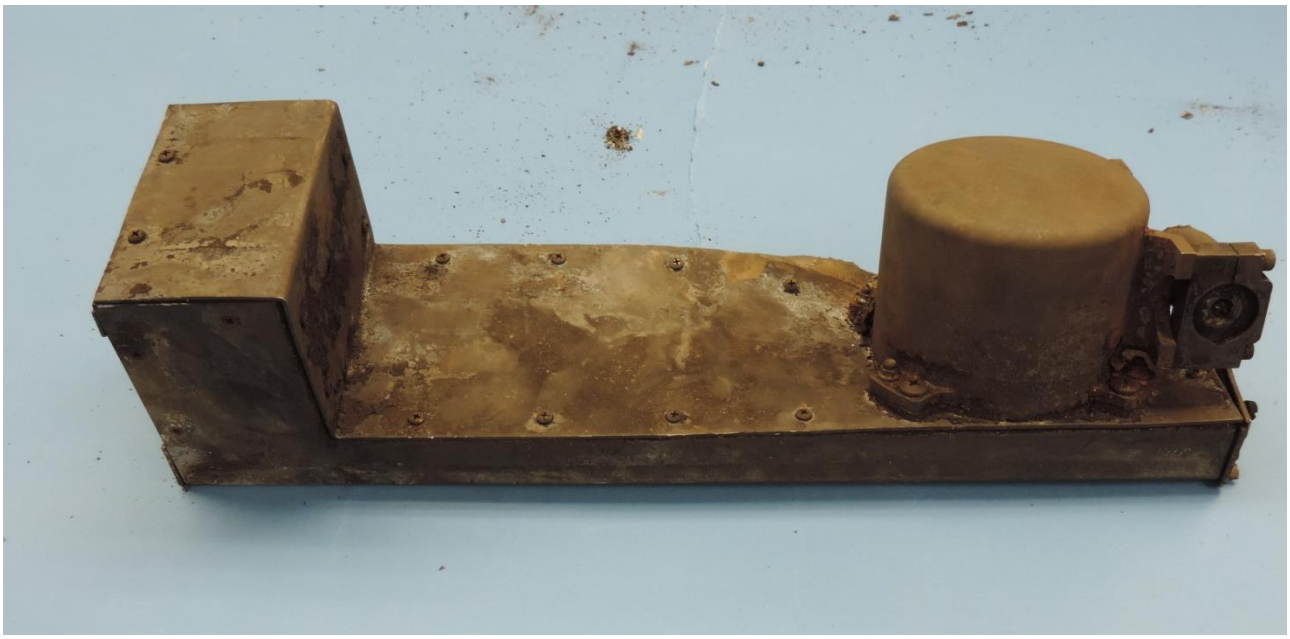


Figure 2. FDR - Right Side

Figure 3. FDR - Front Right Corner

Figure 4. FDR - Crash Survivable Module

Figure 5. FDR - Crash Survivable Insulation

Figure 6. FDR - Memory Module

Figure 7. FDR - Memory Module Bottom

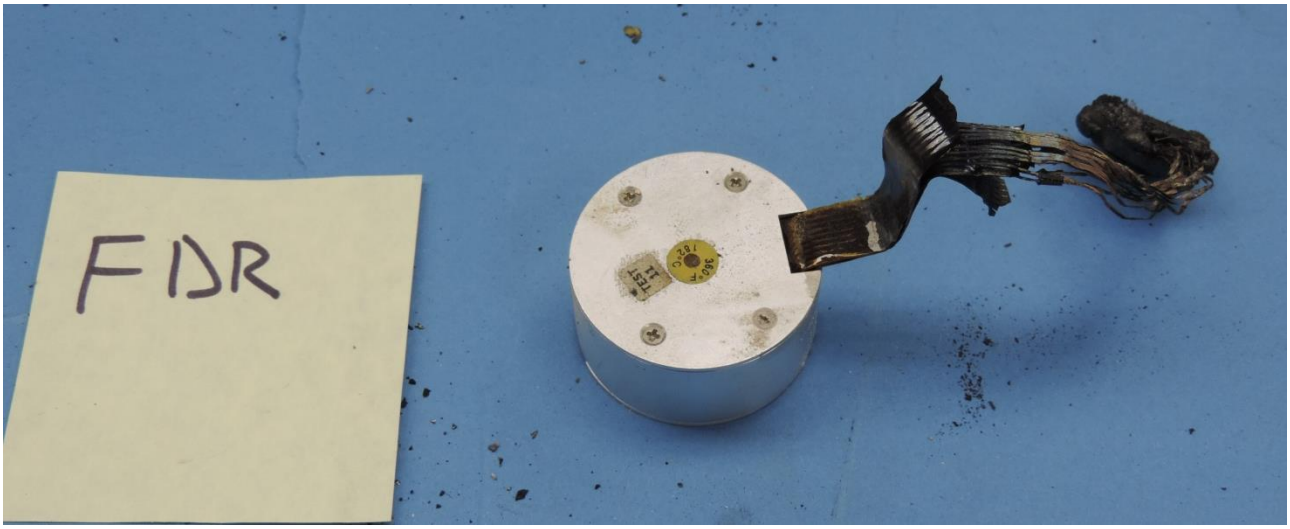
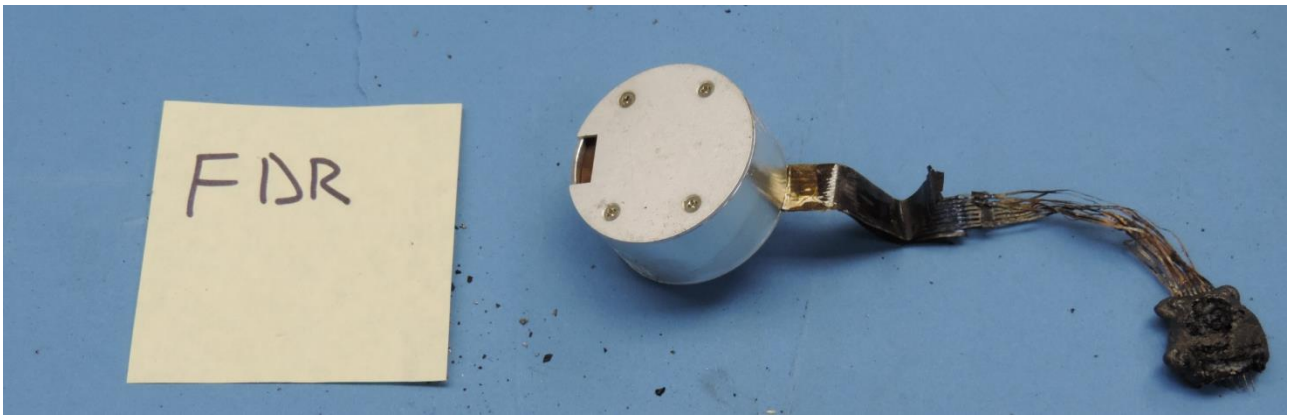


Figure 8. FDR - Memory Module Top



4.2. Recording Description

The FDR recording contained approximately 70.4 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 46 minutes. The parameters evaluated for the purpose of this report appeared to be in accordance with the federal FDR carriage requirements, except Ctrl Col Frc-R[1]. The Ctrl Col Frc-R parameter recorded a "no computed data" pattern for the duration of the flight indicating that the recording system was not receiving data from the source system. According to the operator, failure of this parameter is not uncommon in their A300 fleet but the failure on the accident aircraft had not yet been detected by their maintenance program.

[1] The Ctrl Col Frc-R parameter is the recording of the input control force on the right (or First Officer's) control column. It is one of several parameters required by 14 CFR Part 121.344(a)(88).

4.2.1. Engineering Units Conversions

The engineering units conversions used for the data contained in this report are based on documentation from the operator and 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=+).[2]

Appendix A lists the FDR parameters verified and provided in this report.

4.2.1.1. Pressure Altitude

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.

In order to capture altitude at a high enough resolution over the entire range required, the pressure altitude parameter was stored as two components in different locations in the data map. The most significant part (MSP) is stored only once every 4 seconds while the least significant part (LSP) is stored every second. To determine the combined total pressure altitude, the MSP and LSP of the parameter are concatenated and converted to engineering units. Because the MSP was stored at a lower rate than the LSP, the resultant combined parameter data often had spikes of one to three samples as the parameter value passed through a point where the LSP wrapped. These spikes have not been corrected in the plotted or tabular data.

4.2.2. Filtered Parameters

The following parameters recorded on the FDR are filtered: Elevator Position, Aileron Positions, and Rudder Position. The data included in this report have not been de-filtered. Documentation of the de-filtering method can be found in Airbus document SIL#31-038.

4.3. Time Correlation

Correlation of the FDR data from SRN to the event local time, central daylight time (CDT), was established with an offset provided by Aircraft Performance Specialist in the Aircraft Performance Study.

Accordingly, the time offset for the event flight data from SRN to local CDT is the following: CDT = SRN – 236085.48 seconds. Therefore, for the rest of this report, all times are referenced as CDT, not SRN, to the nearest whole second.

4.4. Observations and Plots

The FDR Group compiled the following observations based upon validated data from the accident aircraft's flight data recorder. These observations are based on the data shown in the following plots.

[2] 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 = +.

4.4.1. Summary of Observations

The group examined most parameters over the time period from approximately 10,000' on approach through the end of the recording. Some parameters were reviewed for the timeframe during or prior to take-off for validation purposes.

- The engines appeared to respond to thrust lever movements in an appropriate manner throughout the timeframes reviewed.

- Control surfaces (ailerons, flaps, slats, elevators, rudder, etc.) appeared to respond appropriately to control inputs.

- Onboard navigation systems (GPS, Localizer, VOR, DME, etc.) showed no faults and recorded data appears to be appropriate for the approach.

- About 5 minutes before the end of the FDR recording (04:42:35 CDT), the recorded pressure altitude was about 10,000', recorded DME was 20.6NM, computed airspeed was about 248 knots, and the speed brake handle was fully extended.

- About 04:42:55 CDT, landing gear discrete parameters indicated all three landing gear were down and locked.

- At about 04:44:22 CDT, the lateral AFCS mode changed to localizer track mode.

- About 04:44:41 CDT, the speed brake handle retracted. Over the next 60 seconds the handle periodically moved to various positions between retracted and full extension.

- At about the same time, the slats/flaps control lever moved from detent 1 (slats/flaps up) to detent 2 (slats 15/flaps 0).

- About 2 minutes and 22 seconds before the end of the FDR recording (04:45:12 CDT), the longitudinal AFCS mode changed to altitude mode. At this time the recorded pressure altitude was about 2,500', recorded DME was about 9NM, and computed airspeed was about 213 knots. At about the same time the selected airspeed changed from 170 knots to 160 knots.

- About 04:45:15 CDT, the slats/flaps control lever moved to detent 3 (slats 15/ flaps 15).

- At about 04:45:32 CDT, the lateral AFCS mode changed to NAV mode, then 2 seconds later (04:45:34 CDT) the mode changed to heading mode. About 4 seconds later (04:45:38 CDT) the mode changed to localizer capture then (about 9 seconds later) back to localizer track mode where it remained for the duration of the FDR recording.

- About 04:45:42 CDT, the slats/flaps control lever moved to detent 4 (slats 15/ flaps 20).

- About 04:45:45 CDT, the speed brake handle returned to 0 where it remained for the duration of the FDR recording.

- About 04:45:47 CDT, the ground spoiler discrete parameter indicates the ground spoilers were armed.

- At about 04:45:48 CDT the selected airspeed changed to 137 knots where it remained for the duration of the FDR recording.

- About 04:45:56 CDT, the slats/flaps control lever moved to detent 5 (slats 30/ flaps 40).

- At about 04:46:01 CDT the longitudinal AFCS mode changed to vertical speed mode. The selected vertical speed was initially set to about -700 fpm about 7 seconds later (04:46:08 CDT).

- At about 04:46:15 CDT the computed airspeed converged to the selected airspeed of 137 knots.

- About the same time, 79 seconds before the end of the FDR recording, the recorded pressure altitude decreased below 2500' which indicated the start of the final descent, recorded DME was about 5.75NM.

- About 04:46:20 CDT the recorded selected vertical speed changed to about -1000 fpm followed 14 seconds later (04:46:34 CDT) by a change to about -1500 fpm.

- About 04:46:38 CDT the recorded selected altitude changed from about 2500' to about 3775'.

- Over the next 45 seconds the parameters reviewed did not indicate a significant change in the state of the aircraft.

- At about 04:47:25 CDT a three second EGPWS sink rate warning was recorded. At this time the recorded vertical speed was -1536' fpm and the recorded radio altitude was 235'.

- At about 04:47:26 CDT the selected vertical speed changed to about -640 fpm followed 3 seconds later by a change to about -448 fpm.

- Starting at about the same time the control column position began increasing to its final recorded value of about 5 degrees in the nose up direction and the recorded pitch attitude increased similarly.

- At 04:47:30 CDT a slight increase in thrust was indicated by the engine parameters.

- At 04:47:32 CDT throttle resolver angle indicated an additional request for increased thrust. The recorded N1, N2, EGT and fuel flow parameters indicate that the engines responded to the request.

- In the last second of the FDR recording (04:47:33 CDT) the left autopilot command discrete change to disengaged, an autopilot off warning was indicated, and the auto throttles changed from speed mode to retard mode. The last recorded pitch attitude was about 7 degrees nose up, airspeed was about 138 knots, and radio altitude was 14 ft.

- The FDR recording ended at approximately 04:47:34 CDT.

4.4.2. FDR Plots and Corresponding Tabular Data

The following 18 figures contain FDR data recorded during the August 14, 2013, event which support the findings above. The following plots do not include all parameters and time ranges evaluated by the group.

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 these 18 plots are provided in compressed (zipped) electronic (*.csv[3]) format as Attachment 1 to this report. Tabular data are included for all parameters evaluated for the time period from the beginning of the flight through the end of the recording.

[3] Comma Separated Value format.

Figure 9

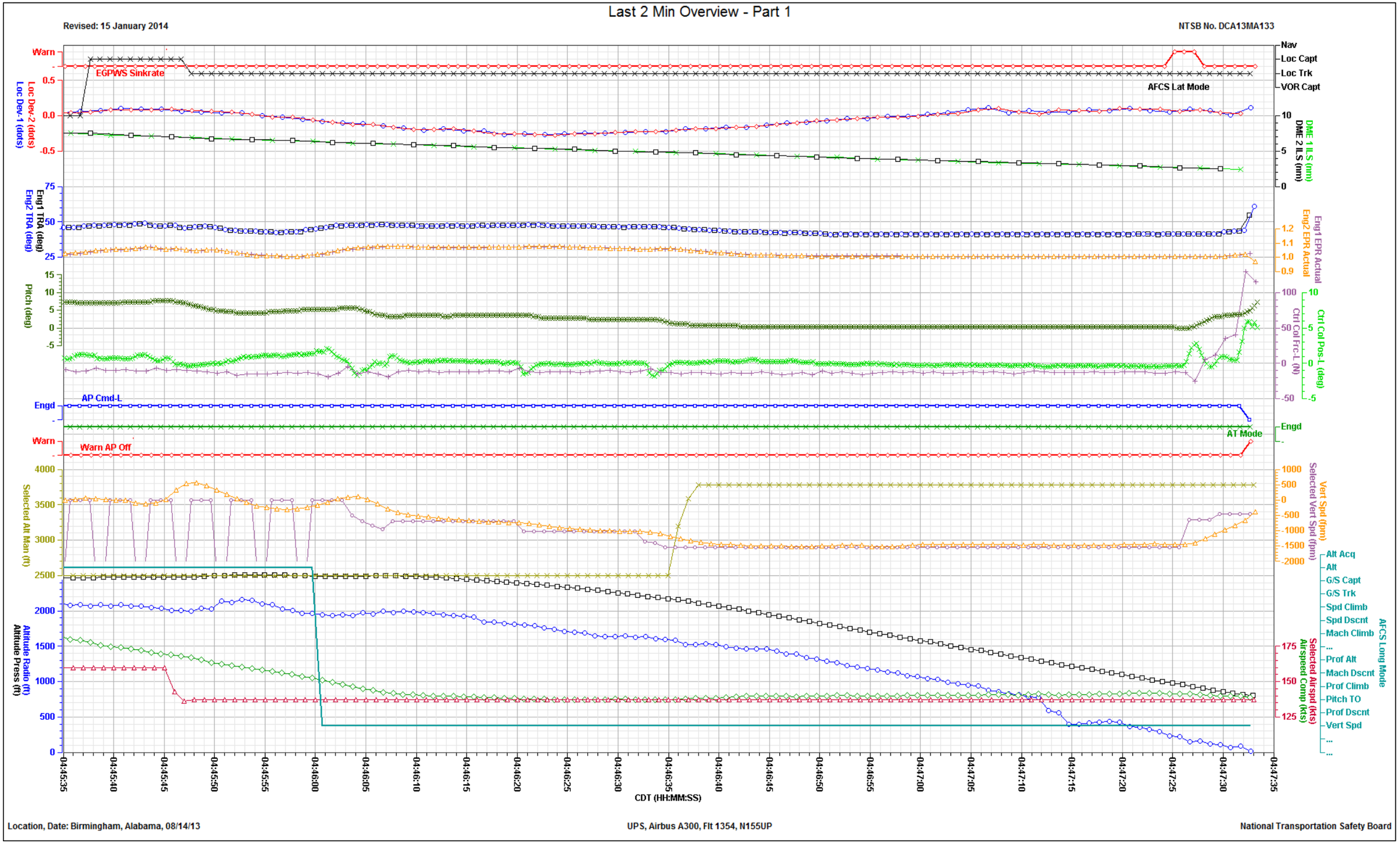

Last 2 Min Overview - Part 1
Revised: 15 January 2014
NTSB No. DCA13MA133
Warn
EGPWS Sinkrate
Loc Dev-1 (dots)
Loc Dev-2 (dots)
0.5
0.0
-0.5
Nav
Loc Capt
Loc Trk
VOR Capt
AFCS Lat Mode
DME 1 ILS (nm)
DME 2 ILS (nm)
10
5
0
Eng1 TRA (deg)
Eng2 TRA (deg)
75
50
25
Eng1 EPR Actual
Eng2 EPR Actual
1.2
1.1
1.0
0.9
Pitch (deg)
15
10
5
0
-5
Ctrl Col Frc-L (N)
100
50
0
-50
Ctrl Col Pos-L (deg)
10
5
0
-5
Engd
AP Cmd-L
AT Mode
Warn
Warn AP Off
Selected Alt Man (ft)
4000
3500
3000
2500
2000
1500
1000
500
0
Altitude Radio (ft)
Altitude Press (ft)
Selected Vert Spd (fpm)
Vert Spd (fpm)
1000
500
0
-500
-1000
-1500
-2000
Selected Airspd (kts)
Airspeed Comp (kts)
175
150
125
AFCS Long Mode
Alt Acq
Alt
G/S Capt
G/S Trk
Spd Climb
Spd Dscnt
Mach Climb
...
Prof Alt
Mach Dscnt
Prof Climb
Pitch TO
Prof Dscnt
Vert Spd
...
...
04:45:35
04:45:40
04:45:45
04:45:50
04:45:55
04:46:00
04:46:05
04:46:10
04:46:15
04:46:20
04:46:25
04:46:30
04:46:35
04:46:40
04:46:45
04:46:50
04:46:55
04:47:00
04:47:05
04:47:10
04:47:15
04:47:20
04:47:25
04:47:30
04:47:35
CDT (HH:MM:SS)
Location, Date: Birmingham, Alabama, 08/14/13
UPS, Airbus A300, Flt 1354, N155UP
National Transportation Safety Board

Figure 10

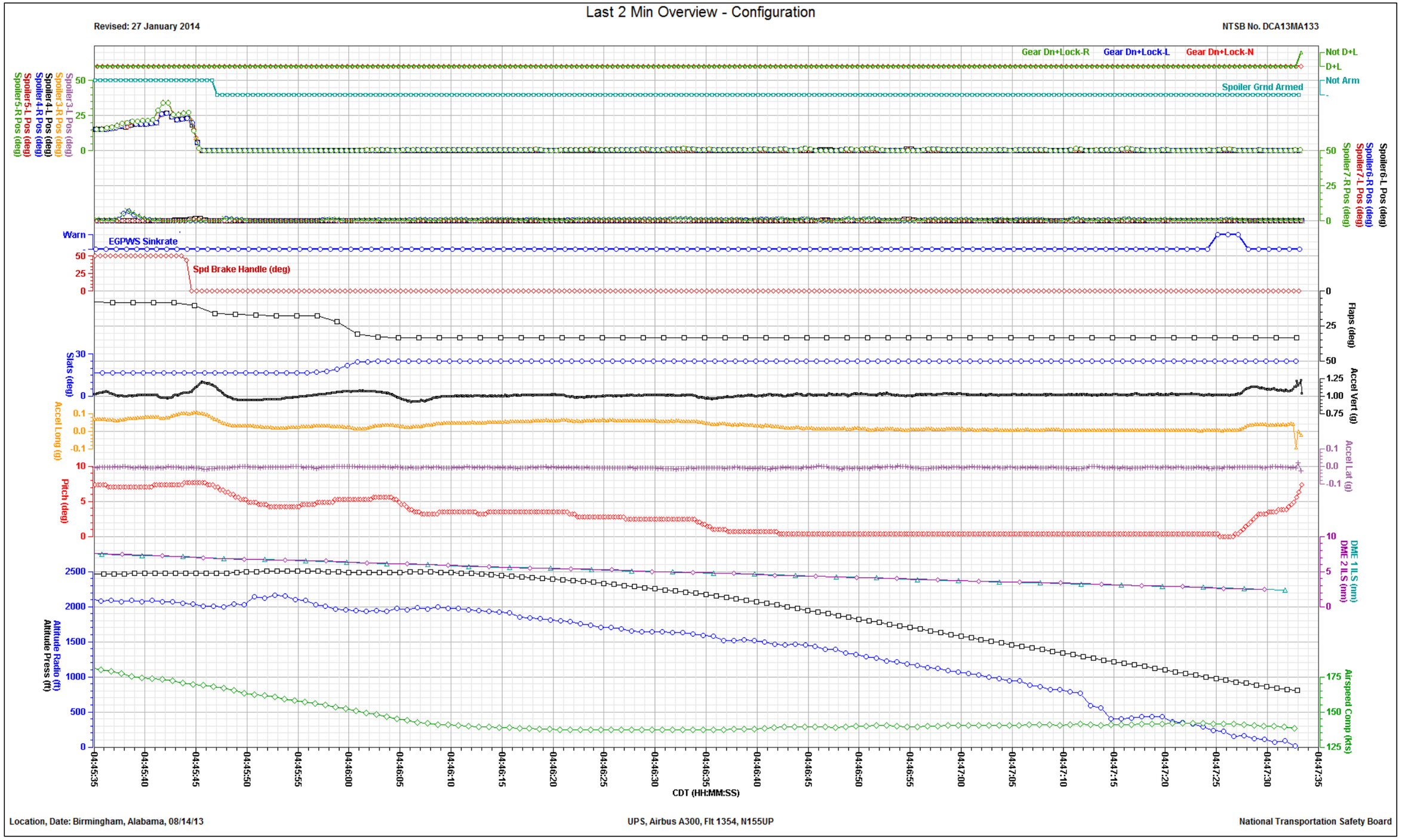

Last 2 Min Overview - Configuration
Revised: 27 January 2014
NTSB No. DCA13MA133
Gear Dn+Lock-R
Gear Dn+Lock-L
Gear Dn+Lock-N
Not D+L
D+L
Not Arm
Spoiler Grnd Armed
Spoiler1-L Pos (deg)
Spoiler1-R Pos (deg)
Spoiler2-L Pos (deg)
Spoiler2-R Pos (deg)
Spoiler3-L Pos (deg)
Spoiler3-R Pos (deg)
Spoiler4-L Pos (deg)
Spoiler4-R Pos (deg)
Spoiler5-L Pos (deg)
Spoiler5-R Pos (deg)
Spoiler6-L Pos (deg)
Spoiler6-R Pos (deg)
Spoiler7-L Pos (deg)
Spoiler7-R Pos (deg)
Warn
EGPWS Sinkrate
Spd Brake Handle (deg)
Flaps (deg)
Slats (deg)
Accel Vert (g)
Accel Long (g)
Accel Lat (g)
Pitch (deg)
DME 1 ILS (nm)
DME 2 ILS (nm)
Altitude Radio (ft)
Altitude Press (ft)
Airspeed Comp (kts)
CDT (HH:MM:SS)
Location, Date: Birmingham, Alabama, 08/14/13
UPS, Airbus A300, Flt 1354, N155UP
National Transportation Safety Board

Figure 11

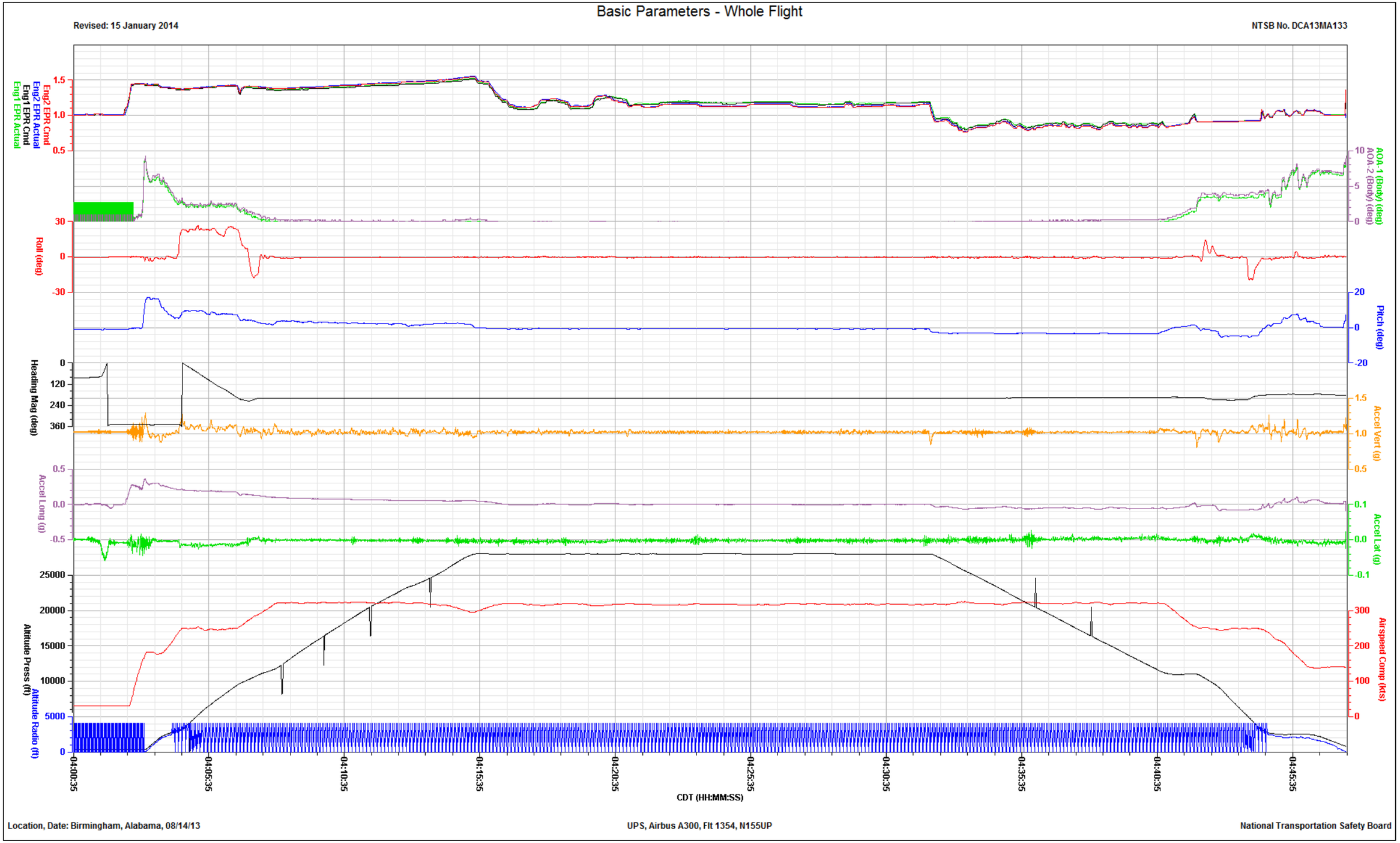

Basic Parameters - Whole Flight
Revised: 15 January 2014
NTSB No. DCA13MA133
Eng1 EPR Actual
Eng1 EPR Cmd
Eng2 EPR Actual
Eng2 EPR Cmd
1.5
1.0
0.5
AOA-1 (Body) (deg)
AOA-2 (Body) (deg)
10
5
0
30
Roll (deg)
0
-30
20
Pitch (deg)
0
-20
Heading Mag (deg)
0
120
240
360
1.5
Accel Vert (g)
1.0
0.5
0.5
Accel Long (g)
0.0
-0.5
0.1
Accel Lat (g)
0.0
-0.1
25000
20000
15000
10000
5000
0
Altitude Press (ft)
Altitude Radio (ft)
300
Airspeed Comp (kts)
200
100
0
04:00:35
04:05:35
04:10:35
04:15:35
04:20:35
04:25:35
04:30:35
04:35:35
04:40:35
04:45:35
CDT (HH:MM:SS)
Location, Date: Birmingham, Alabama, 08/14/13
UPS, Airbus A300, Flt 1354, N155UP
National Transportation Safety Board

Figure 12

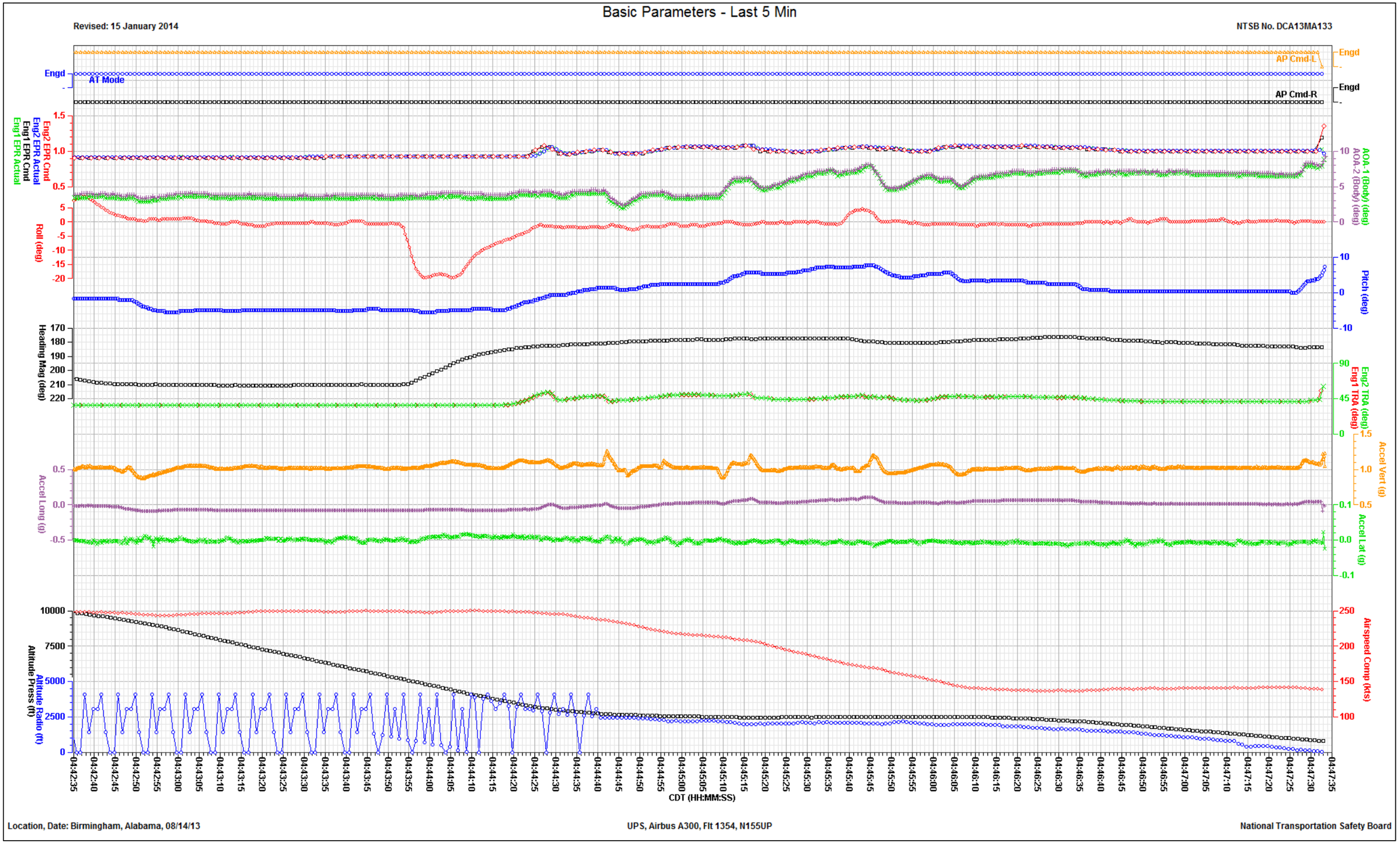
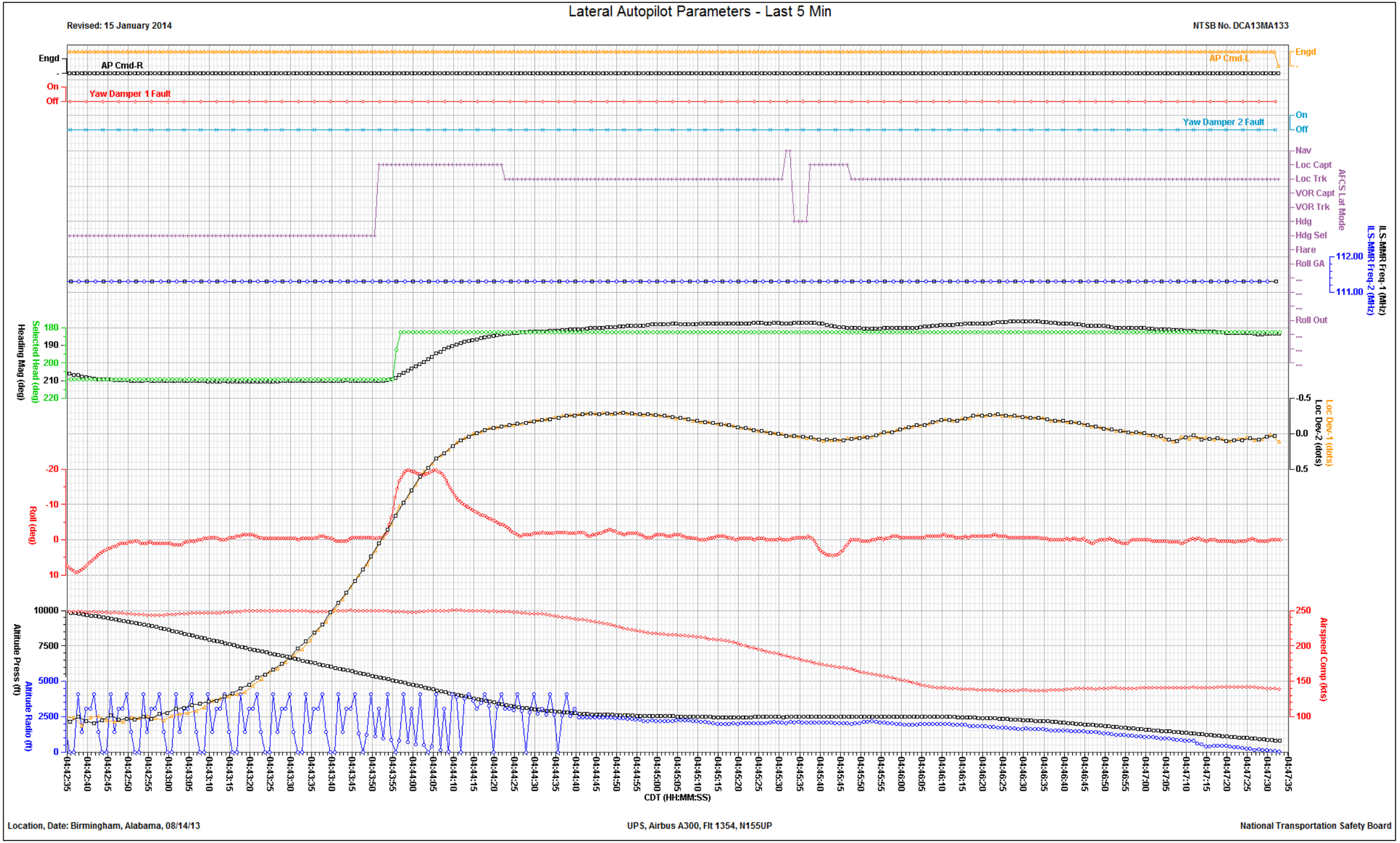

Basic Parameters - Last 5 Min
Revised: 15 January 2014
NTSB No. DCA13MA133
Engd
AT Mode
AP Cmd-L
AP Cmd-R
Eng2 EPR Cmd
Eng2 EPR Actual
Eng1 EPR Cmd
Eng1 EPR Actual
Roll (deg)
AOA-1 (Body) (deg)
AOA-2 (Body) (deg)
Pitch (deg)
Heading Mag (deg)
Eng2 TRA (deg)
Eng1 TRA (deg)
Accel Vert (g)
Accel Long (g)
Accel Lat (g)
Altitude Press (ft)
Altitude Radio (ft)
Airspeed Comp (kts)
CDT (HH:MM:SS)
Location, Date: Birmingham, Alabama, 08/14/13
UPS, Airbus A300, Flt 1354, N155UP
National Transportation Safety Board

Figure 13


Lateral Autopilot Parameters - Last 5 Min
Revised: 15 January 2014
NTSB No. DCA13MA133
Engd
AP Cmd-R
AP Cmd-L
On
Off
Yaw Damper 1 Fault
Yaw Damper 2 Fault
Nav
Loc Capt
Loc Trk
VOR Capt
VOR Trk
Hdg
Hdg Sel
Flare
Roll GA
Roll Out
AFCS Lat Mode
ILS-MMR Freq-1 (MHz)
ILS-MMR Freq-2 (MHz)
112.00
111.00
Heading Mag (deg)
Selected Head (deg)
180
190
200
210
220
Roll (deg)
-20
-10
0
10
Loc Dev-1 (dots)
Loc Dev-2 (dots)
-0.5
0.0
0.5
Altitude Press (ft)
Altitude Radio (ft)
10000
7500
5000
2500
0
Airspeed Comp (kts)
250
200
150
100
04:42:35
04:42:40
04:42:45
04:42:50
04:42:55
04:43:00
04:43:05
04:43:10
04:43:15
04:43:20
04:43:25
04:43:30
04:43:35
04:43:40
04:43:45
04:43:50
04:43:55
04:44:00
04:44:05
04:44:10
04:44:15
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04:44:40
04:44:45
04:44:50
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04:46:00
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04:46:10
04:46:15
04:46:20
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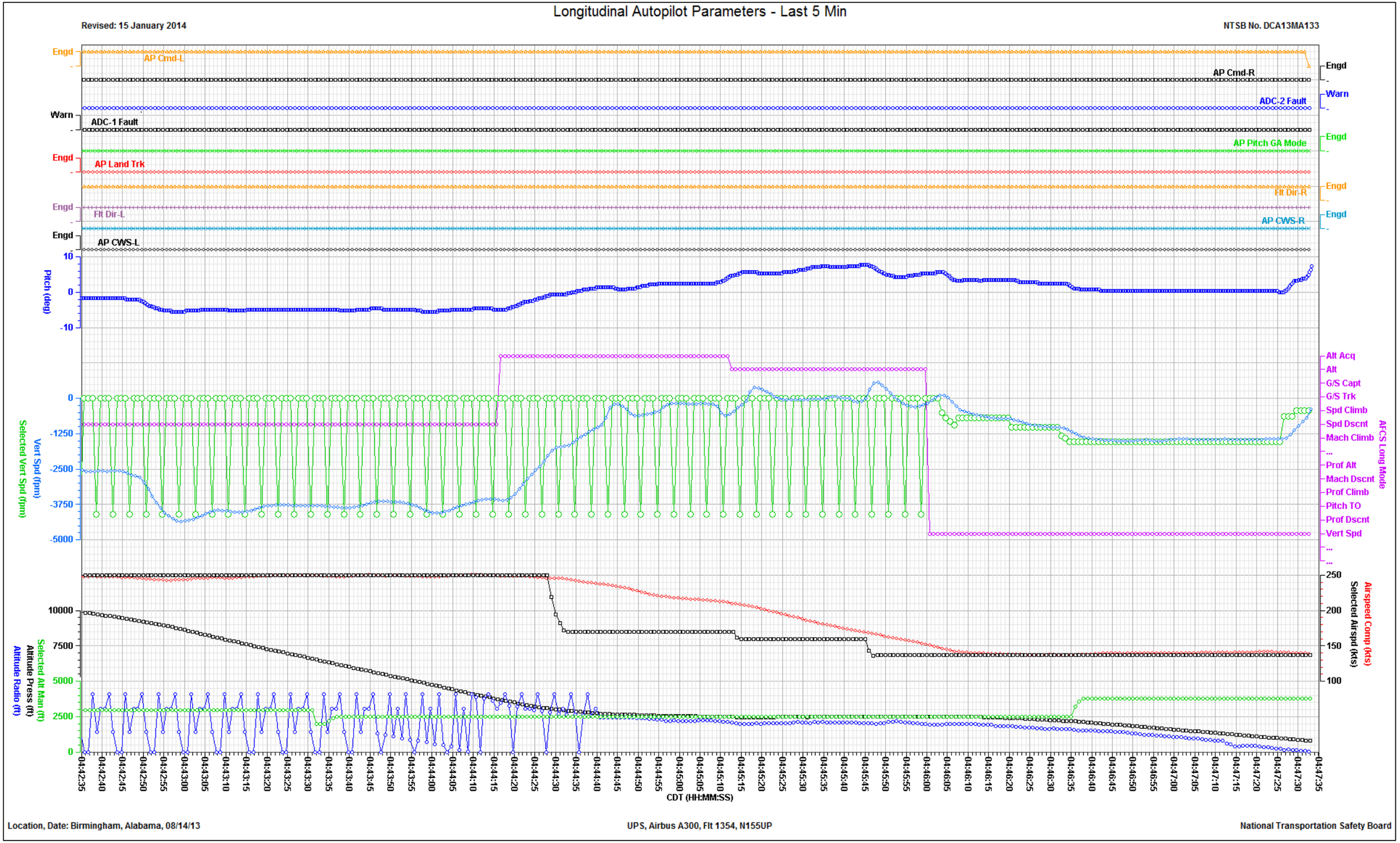
04:46:45
04:46:50
04:46:55
04:47:00
04:47:05
04:47:10
04:47:15
04:47:20
04:47:25
04:47:30
04:47:35
CDT (HH:MM:SS)
Location, Date: Birmingham, Alabama, 08/14/13
UPS, Airbus A300, Flt 1354, N155UP
National Transportation Safety Board

Figure 14


Longitudinal Autopilot Parameters - Last 5 Min
Revised: 15 January 2014
NTSB No. DCA13MA133
Engd
AP Cmd-L
AP Cmd-R
Warn
ADC-1 Fault
ADC-2 Fault
AP Land Trk
AP Pitch GA Mode
Flt Dir-L
Flt Dir-R
AP CWS-L
AP CWS-R
Pitch (deg)
10
0
-10
Vert Spd (fpm)
Selected Vert Spd (fpm)
0
-1250
-2500
-3750
-5000
Alt Acq
Alt
G/S Capt
G/S Trk
Spd Climb
Spd Dscnt
Mach Climb
...
Prof Alt
Mach Dscnt
Prof Climb
Pitch TO
Prof Dscnt
Vert Spd
AFCS Long Mode
10000
7500
5000
2500
0
Altitude Press (ft)
Selected Alt Man (ft)
Altitude Radio (ft)
250
200
150
100
Airspeed Comp (kts)
Selected Airspd (kts)
04:42:35
04:42:40
04:42:45
04:42:50
04:42:55
04:43:00
04:43:05
04:43:10
04:43:15
04:43:20
04:43:25
04:43:30
04:43:35
04:43:40
04:43:45
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04:47:10
04:47:15
04:47:20
04:47:25
04:47:30
04:47:35
CDT (HH:MM:SS)
Location, Date: Birmingham, Alabama, 08/14/13
UPS, Airbus A300, Flt 1354, N155UP
National Transportation Safety Board

Figure 15

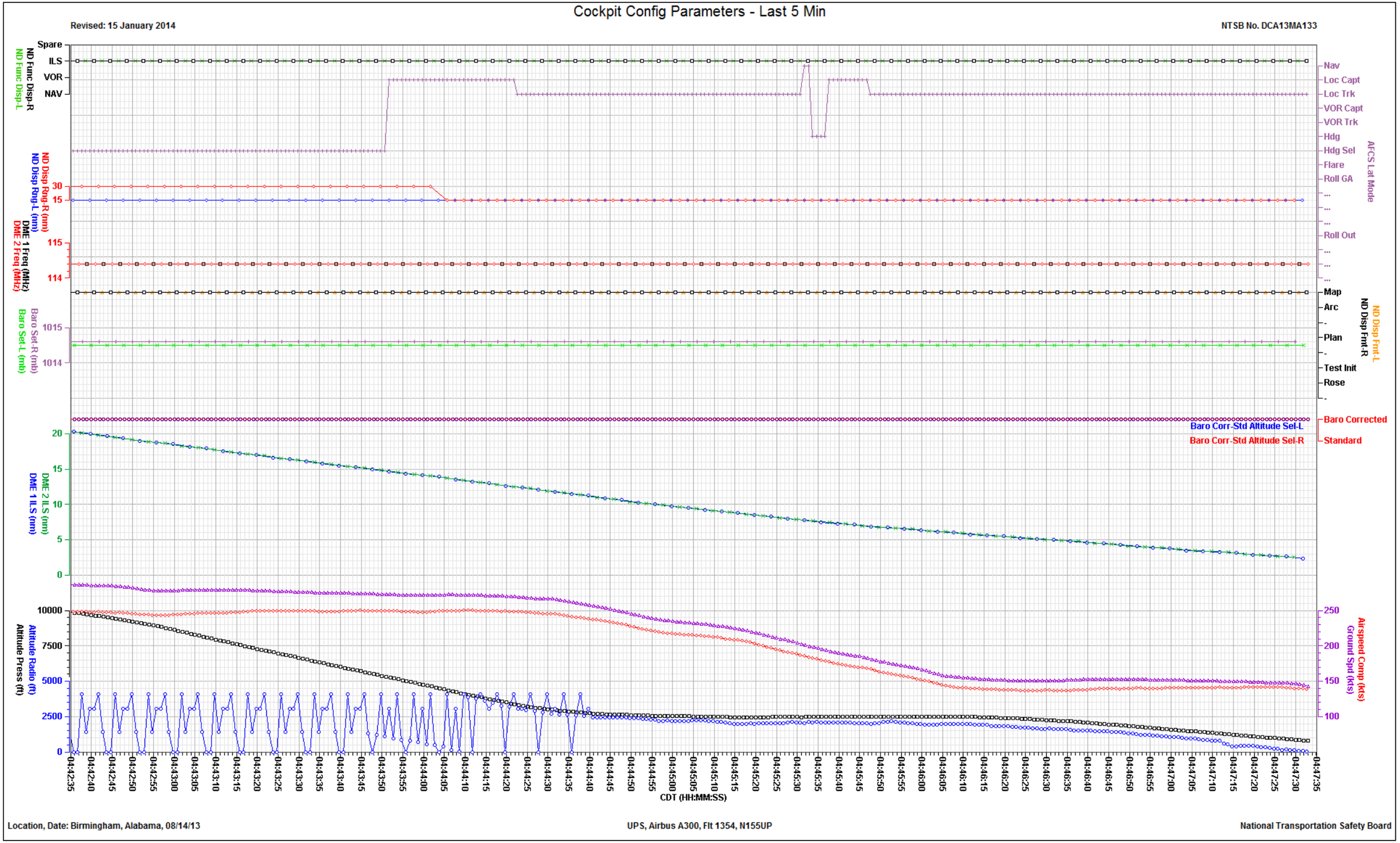

Cockpit Config Parameters - Last 5 Min
Revised: 15 January 2014
NTSB No. DCA13MA133
ND Func Disp-L
ND Func Disp-R
Spare
ILS
VOR
NAV
ND Disp Rng-L (nm)
ND Disp Rng-R (nm)
30
15
DME 1 Freq (MHz)
DME 2 Freq (MHz)
115
114
Baro Set-L (mb)
Baro Set-R (mb)
1015
1014
DME 1 ILS (nm)
DME 2 ILS (nm)
20
15
10
5
0
Altitude Press (ft)
Altitude Radio (ft)
10000
7500
5000
2500
0
AFCS Lat Mode
Nav
Loc Capt
Loc Trk
VOR Capt
VOR Trk
Hdg
Hdg Sel
Flare
Roll GA
Roll Out
ND Disp Fmt-L
ND Disp Fmt-R
Map
Arc
Plan
Test Init
Rose
Baro Corrected
Standard
Baro Corr-Std Altitude Sel-L
Baro Corr-Std Altitude Sel-R
Airspeed Comp (kts)
Ground Spd (kts)
250
200
150
100
04:42:35
04:42:40
04:42:45
04:42:50
04:42:55
04:43:00
04:43:05
04:43:10
04:43:15
04:43:20
04:43:25
04:43:30
04:43:35
04:43:40
04:43:45
04:43:50
04:43:55
04:44:00
04:44:05
04:44:10
04:44:15
04:44:20
04:44:25
04:44:30
04:44:35
04:44:40
04:44:45
04:44:50
04:44:55
04:45:00
04:45:05
04:45:10
04:45:15
04:45:20
04:45:25
04:45:30
04:45:35
04:45:40
04:45:45
04:45:50
04:45:55
04:46:00
04:46:05
04:46:10
04:46:15
04:46:20
04:46:25
04:46:30
04:46:35
04:46:40
04:46:45
04:46:50
04:46:55
04:47:00
04:47:05
04:47:10
04:47:15
04:47:20
04:47:25
04:47:30
04:47:35
CDT (HH:MM:SS)
Location, Date: Birmingham, Alabama, 08/14/13
UPS, Airbus A300, Flt 1354, N155UP
National Transportation Safety Board

Figure 16

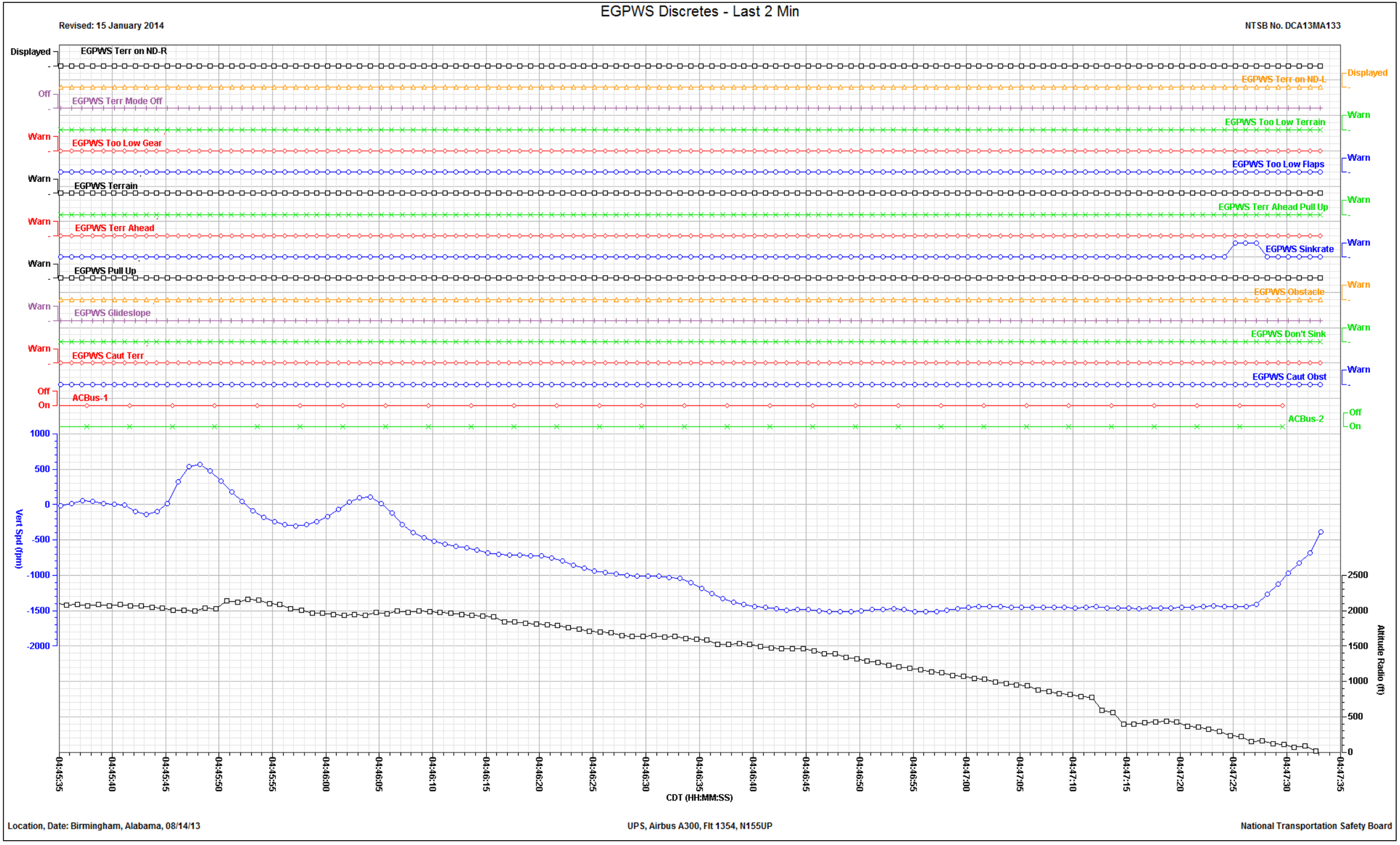

EGPWS Discretes - Last 2 Min
Revised: 15 January 2014
NTSB No. DCA13MA133
Displayed
EGPWS Terr on ND-R
EGPWS Terr on ND-L
Off
EGPWS Terr Mode Off
Warn
EGPWS Too Low Terrain
Warn
EGPWS Too Low Gear
EGPWS Too Low Flaps
Warn
EGPWS Terrain
Warn
EGPWS Terr Ahead Pull Up
Warn
EGPWS Terr Ahead
EGPWS Sinkrate
Warn
EGPWS Pull Up
Warn
EGPWS Obstacle
Warn
EGPWS Glideslope
Warn
EGPWS Don't Sink
Warn
EGPWS Caut Terr
EGPWS Caut Obst
Warn
Off
On
ACBus-1
ACBus-2
Off
On
1000
500
0
-500
-1000
-1500
-2000
Vert Spd (fpm)
2500
2000
1500
1000
500
0
Altitude Radio (ft)
04:45:35
04:45:40
04:45:45
04:45:50
04:45:55
04:46:00
04:46:05
04:46:10
04:46:15
04:46:20
04:46:25
04:46:30
04:46:35
04:46:40
04:46:45
04:46:50
04:46:55
04:47:00
04:47:05
04:47:10
04:47:15
04:47:20
04:47:25
04:47:30
04:47:35
CDT (HH:MM:SS)
Location, Date: Birmingham, Alabama, 08/14/13
UPS, Airbus A300, Flt 1354, N155UP
National Transportation Safety Board

Figure 17

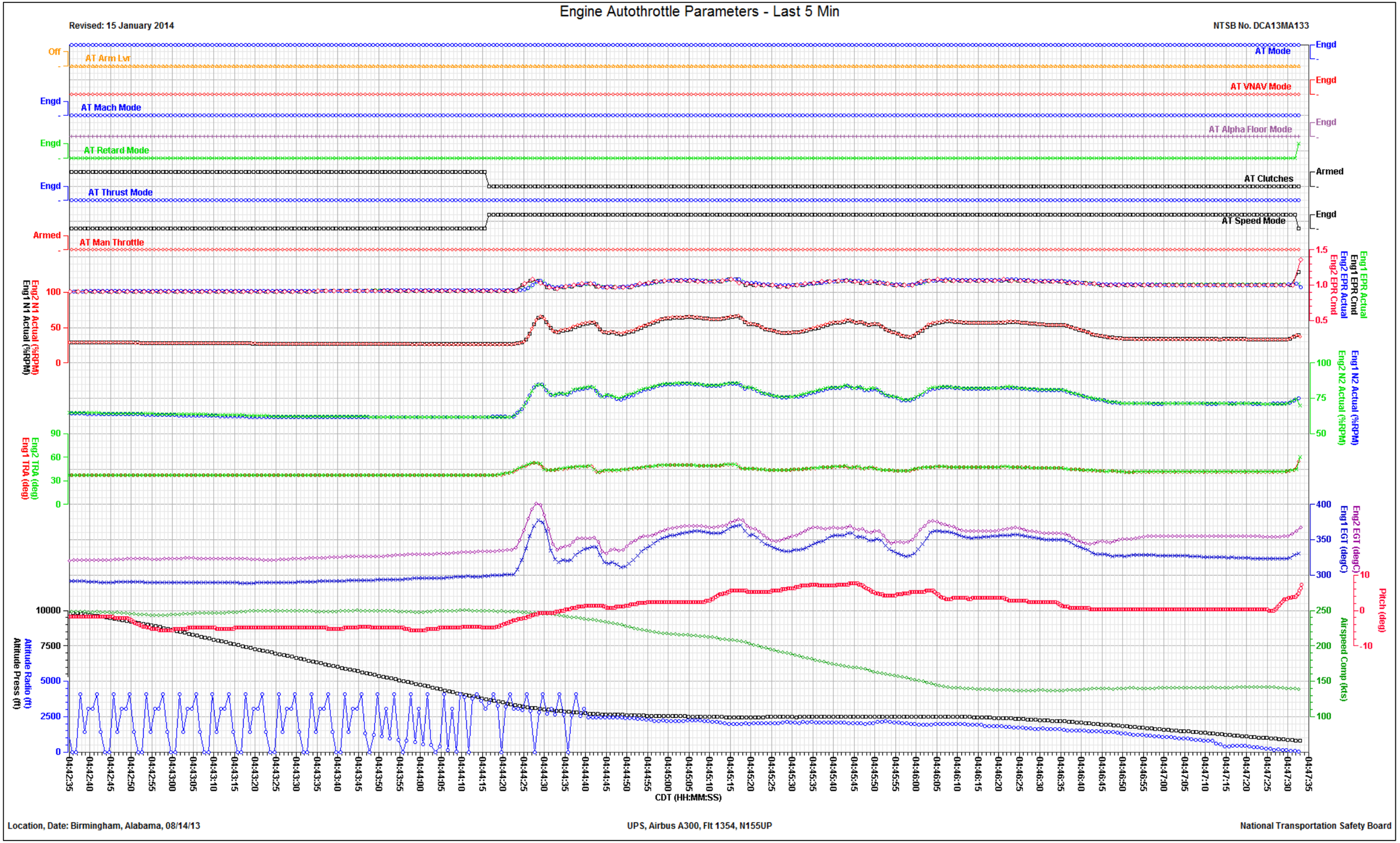

Engine Autothrottle Parameters - Last 5 Min
Revised: 15 January 2014
NTSB No. DCA13MA133
Off
AT Arm Lvr
Engd
AT Mach Mode
Engd
AT Retard Mode
Engd
AT Thrust Mode
Armed
AT Man Throttle
AT Mode
Engd
AT VNAV Mode
Engd
AT Alpha Floor Mode
Engd
AT Clutches
Armed
AT Speed Mode
Engd
Eng2 N1 Actual (%RPM)
Eng1 N1 Actual (%RPM)
100
50
0
Eng1 EPR Actual
Eng1 EPR Cmd
Eng2 EPR Actual
Eng2 EPR Cmd
1.5
1.0
0.5
Eng2 TRA (deg)
Eng1 TRA (deg)
90
60
30
0
Eng1 N2 Actual (%RPM)
Eng2 N2 Actual (%RPM)
100
75
50
Altitude Radio (ft)
Altitude Press (ft)
10000
7500
5000
2500
0
Eng2 EGT (degC)
Eng1 EGT (degC)
400
350
300
250
200
150
100
Pitch (deg)
Airspeed Comp (kts)
10
0
-10
04:42:35
04:42:40
04:42:45
04:42:50
04:42:55
04:43:00
04:43:05
04:43:10
04:43:15
04:43:20
04:43:25
04:43:30
04:43:35
04:43:40
04:43:45
04:43:50
04:43:55
04:44:00
04:44:05
04:44:10
04:44:15
04:44:20
04:44:25
04:44:30
04:44:35
04:44:40
04:44:45
04:44:50
04:44:55
04:45:00
04:45:05
04:45:10
04:45:15
04:45:20
04:45:25
04:45:30
04:45:35
04:45:40
04:45:45
04:45:50
04:45:55
04:46:00
04:46:05
04:46:10
04:46:15
04:46:20
04:46:25
04:46:30
04:46:35
04:46:40
04:46:45
04:46:50
04:46:55
04:47:00
04:47:05
04:47:10
04:47:15
04:47:20
04:47:25
04:47:30
04:47:35
CDT (HH:MM:SS)
Location, Date: Birmingham, Alabama, 08/14/13
UPS, Airbus A300, Flt 1354, N155UP
National Transportation Safety Board

Figure 18

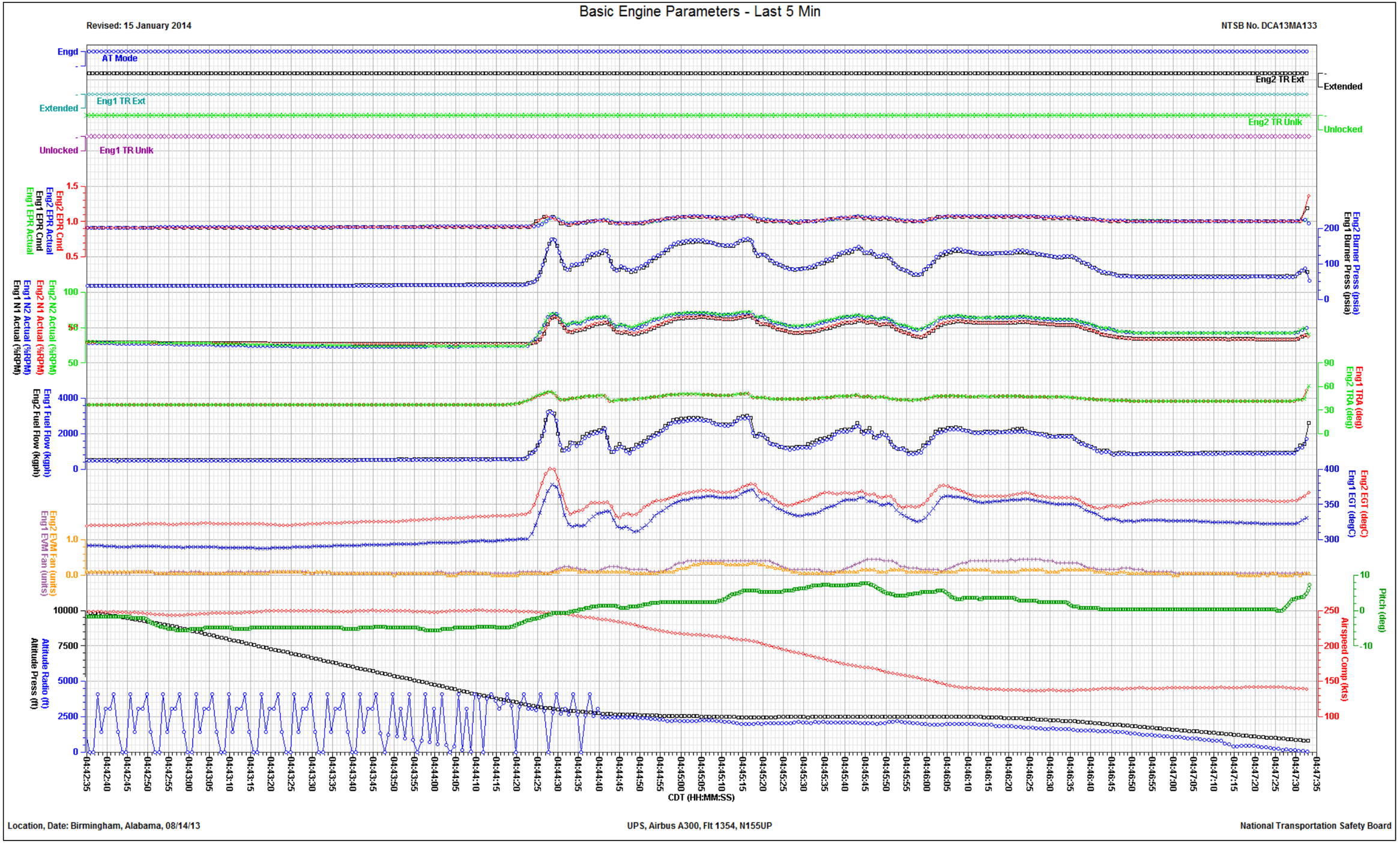

Basic Engine Parameters - Last 5 Min
Revised: 15 January 2014
NTSB No. DCA13MA133
Engd
AT Mode
Eng1 TR Ext
Extended
Eng1 TR Unlk
Unlocked
Eng2 TR Ext
Extended
Eng2 TR Unlk
Unlocked
Eng1 EPR Actual
Eng1 EPR Cmd
Eng2 EPR Actual
Eng2 EPR Cmd
Eng1 N1 Actual (%RPM)
Eng1 N2 Actual (%RPM)
Eng2 N1 Actual (%RPM)
Eng2 N2 Actual (%RPM)
Eng2 Fuel Flow (kgph)
Eng1 Fuel Flow (kgph)
Eng1 EVM Fan (units)
Eng2 EVM Fan (units)
Altitude Press (ft)
Altitude Radio (ft)
Eng1 Burner Press (psia)
Eng2 Burner Press (psia)
Eng1 TRA (deg)
Eng2 TRA (deg)
Eng1 EGT (degC)
Eng2 EGT (degC)
Airspeed Comp (kts)
Pitch (deg)
CDT (HH:MM:SS)
Location, Date: Birmingham, Alabama, 08/14/13
UPS, Airbus A300, Flt 1354, N155UP
National Transportation Safety Board

Figure 19

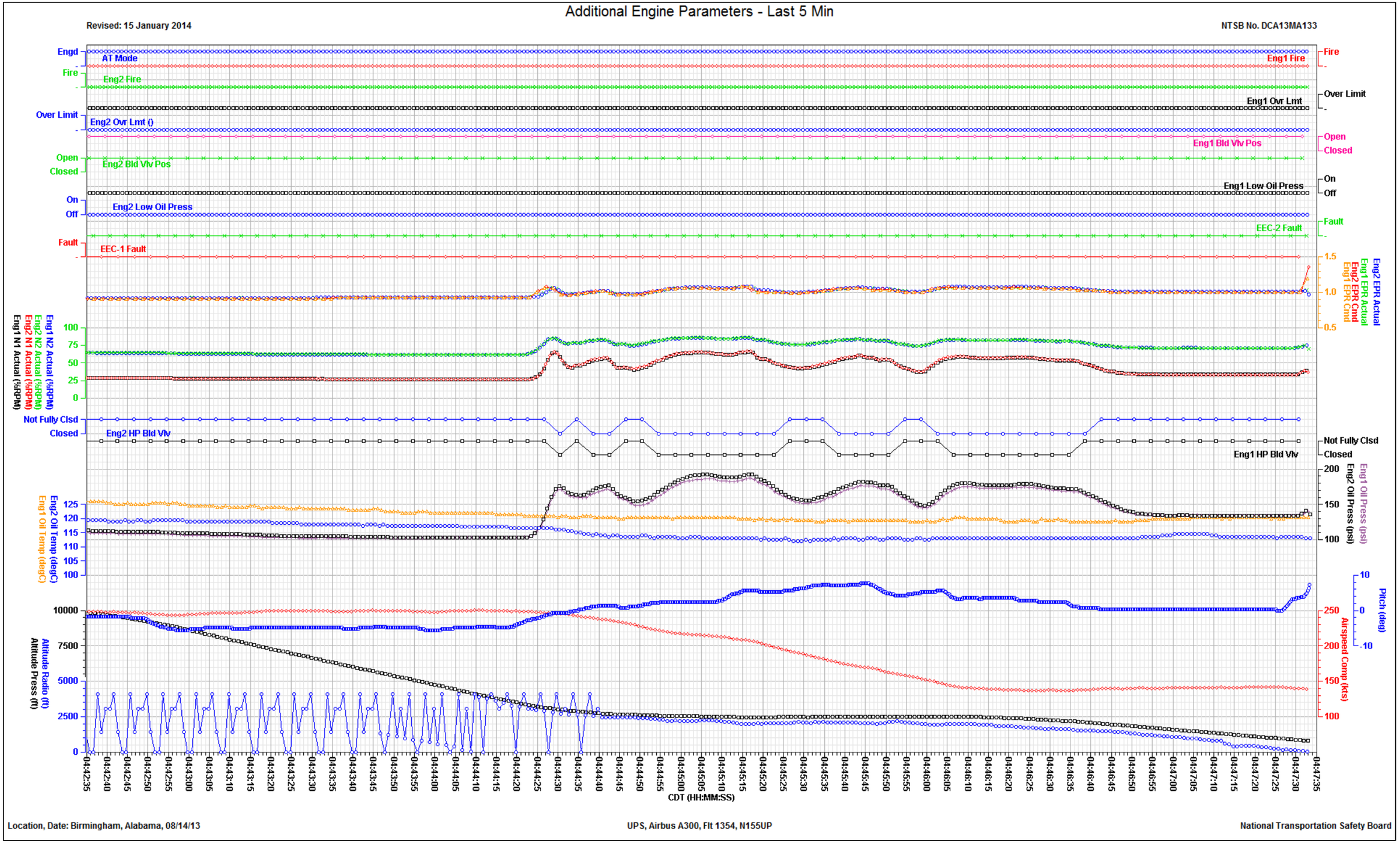

Additional Engine Parameters - Last 5 Min
Revised: 15 January 2014
NTSB No. DCA13MA133
Engd
AT Mode
Fire
Eng2 Fire
Eng1 Fire
Over Limit
Eng2 Ovr Lmt ()
Eng1 Ovr Lmt
Open
Closed
Eng2 Bld Vlv Pos
Eng1 Bld Vlv Pos
On
Off
Eng2 Low Oil Press
Eng1 Low Oil Press
Fault
EEC-1 Fault
EEC-2 Fault
Eng1 N1 Actual (%RPM)
Eng2 N1 Actual (%RPM)
Eng2 N2 Actual (%RPM)
Eng1 N2 Actual (%RPM)
Not Fully Clsd
Closed
Eng2 HP Bld Vlv
Eng1 HP Bld Vlv
Eng1 Oil Temp (degC)
Eng2 Oil Temp (degC)
Altitude Press (ft)
Altitude Ratio (ft)
Eng1 EPR Cmd
Eng2 EPR Cmd
Eng1 EPR Actual
Eng2 EPR Actual
Eng2 Oil Press (psi)
Eng1 Oil Press (psi)
Airspeed Comp (kts)
Pitch (deg)
CDT (HH:MM:SS)
Location, Date: Birmingham, Alabama, 08/14/13
UPS, Airbus A300, Flt 1354, N155UP
National Transportation Safety Board

Figure 20

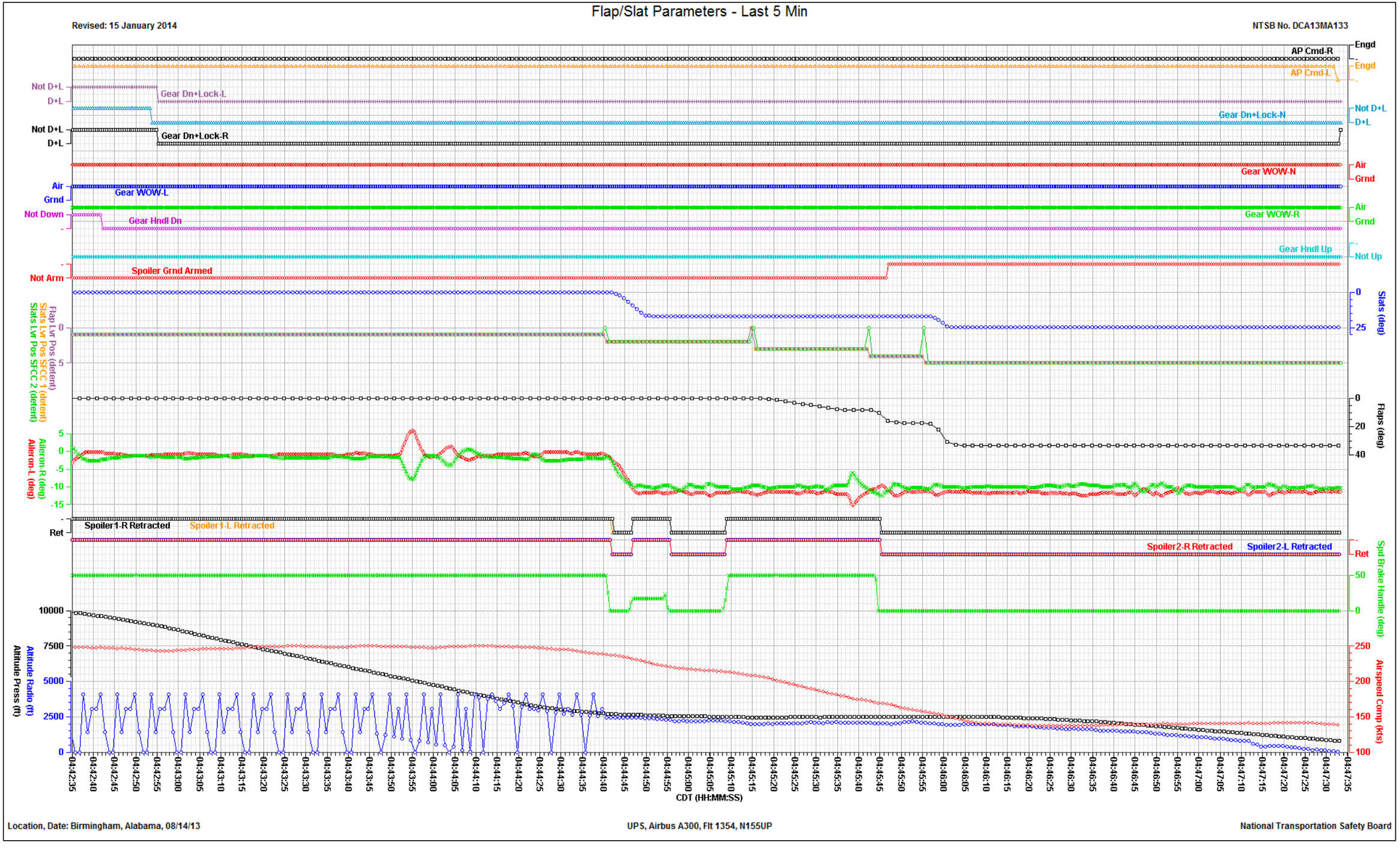

Flap/Slat Parameters - Last 5 Min
Revised: 15 January 2014
NTSB No. DCA13MA133
AP Cmd-R
AP Cmd-L
Engd
Not D+L
D+L
Gear Dn+Lock-L
Gear Dn+Lock-N
Gear Dn+Lock-R
Air
Grnd
Gear WOW-L
Gear WOW-N
Gear WOW-R
Not Down
Gear Hndl Dn
Gear Hndl Up
Not Up
Not Arm
Spoiler Grnd Armed
Flap Lvr Pos (detent)
Slats Lvr Pos SFCC 1 (detent)
Slats Lvr Pos SFCC 2 (detent)
Slats (deg)
Aileron-R (deg)
Aileron-L (deg)
Flaps (deg)
Spoiler1-R Retracted
Spoiler1-L Retracted
Spoiler2-R Retracted
Spoiler2-L Retracted
Ret
Spd Brake Handle (deg)
Altitude Press (ft)
Altitude Radio (ft)
Airspeed Comp (kts)
CDT (HH:MM:SS)
Location, Date: Birmingham, Alabama, 08/14/13
UPS, Airbus A300, Flt 1354, N155UP
National Transportation Safety Board

Figure 21

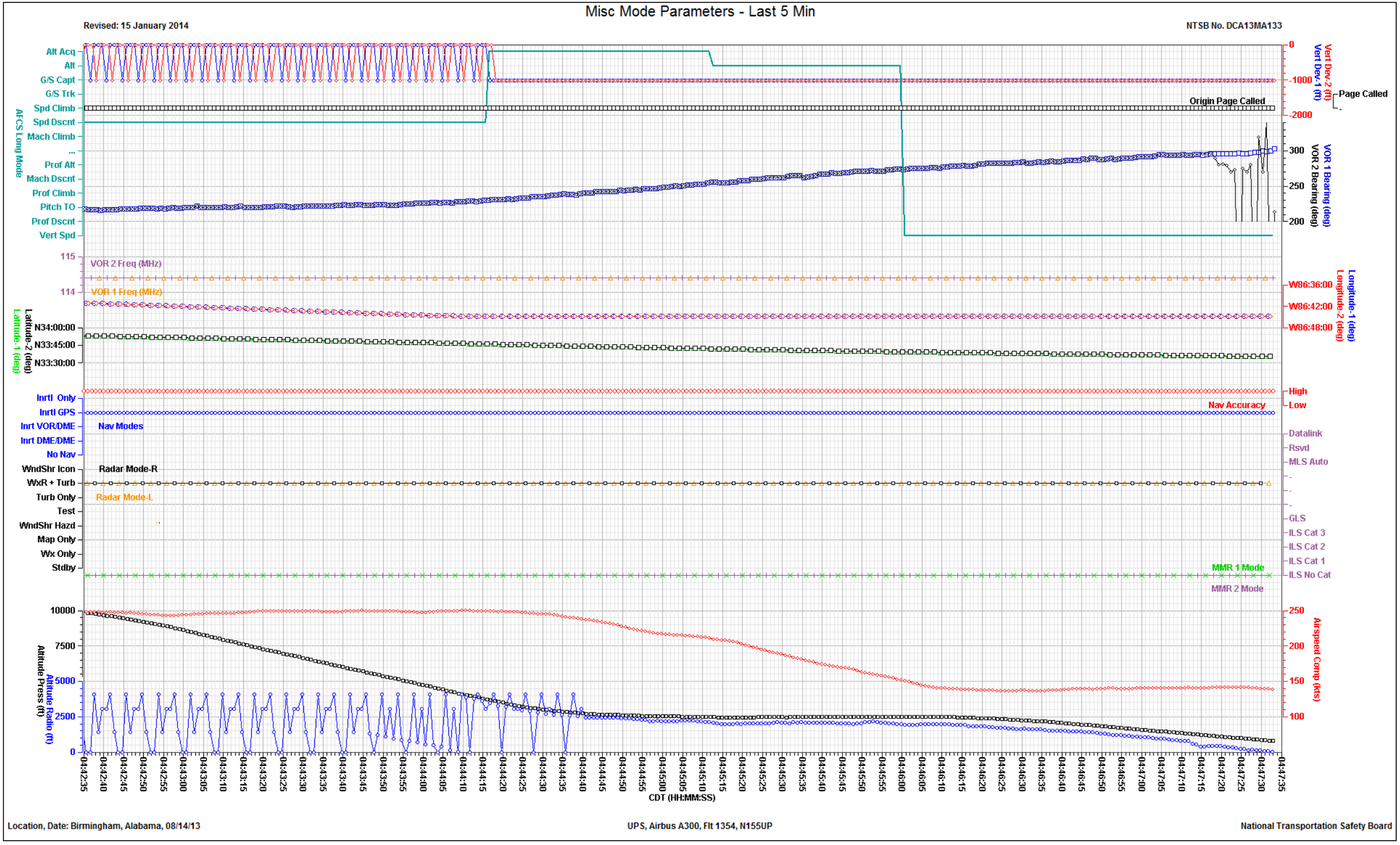

Misc Mode Parameters - Last 5 Min
Revised: 15 January 2014
NTSB No. DCA13MA133
AFCS Long Mode
Alt Acq
Alt
G/S Capt
G/S Trk
Spd Climb
Spd Dscnt
Mach Climb
...
Prof Alt
Mach Dscnt
Prof Climb
Pitch TO
Prof Dscnt
Vert Spd
Origin Page Called
Page Called
Vert Dev-2 (ft)
Vert Dev-1 (ft)
VOR 1 Bearing (deg)
VOR 2 Bearing (deg)
VOR 2 Freq (MHz)
VOR 1 Freq (MHz)
Latitude-2 (deg)
Latitude-1 (deg)
Longitude-1 (deg)
Longitude-2 (deg)
Nav Modes
Inrtl Only
Inrtl GPS
Inrt VOR/DME
Inrt DME/DME
No Nav
Nav Accuracy
High
Low
Radar Mode-R
Radar Mode-L
WndShr Icon
WxR + Turb
Turb Only
Test
WndShr Hazd
Map Only
Wx Only
Stdby
Datalink
Rsvd
MLS Auto
GLS
ILS Cat 3
ILS Cat 2
ILS Cat 1
ILS No Cat
MMR 1 Mode
MMR 2 Mode
Altitude Press (ft)
Altitude Radio (ft)
Airspeed Comp (kts)
CDT (HH:MM:SS)
Location, Date: Birmingham, Alabama, 08/14/13
UPS, Airbus A300, Flt 1354, N155UP
National Transportation Safety Board

Figure 22

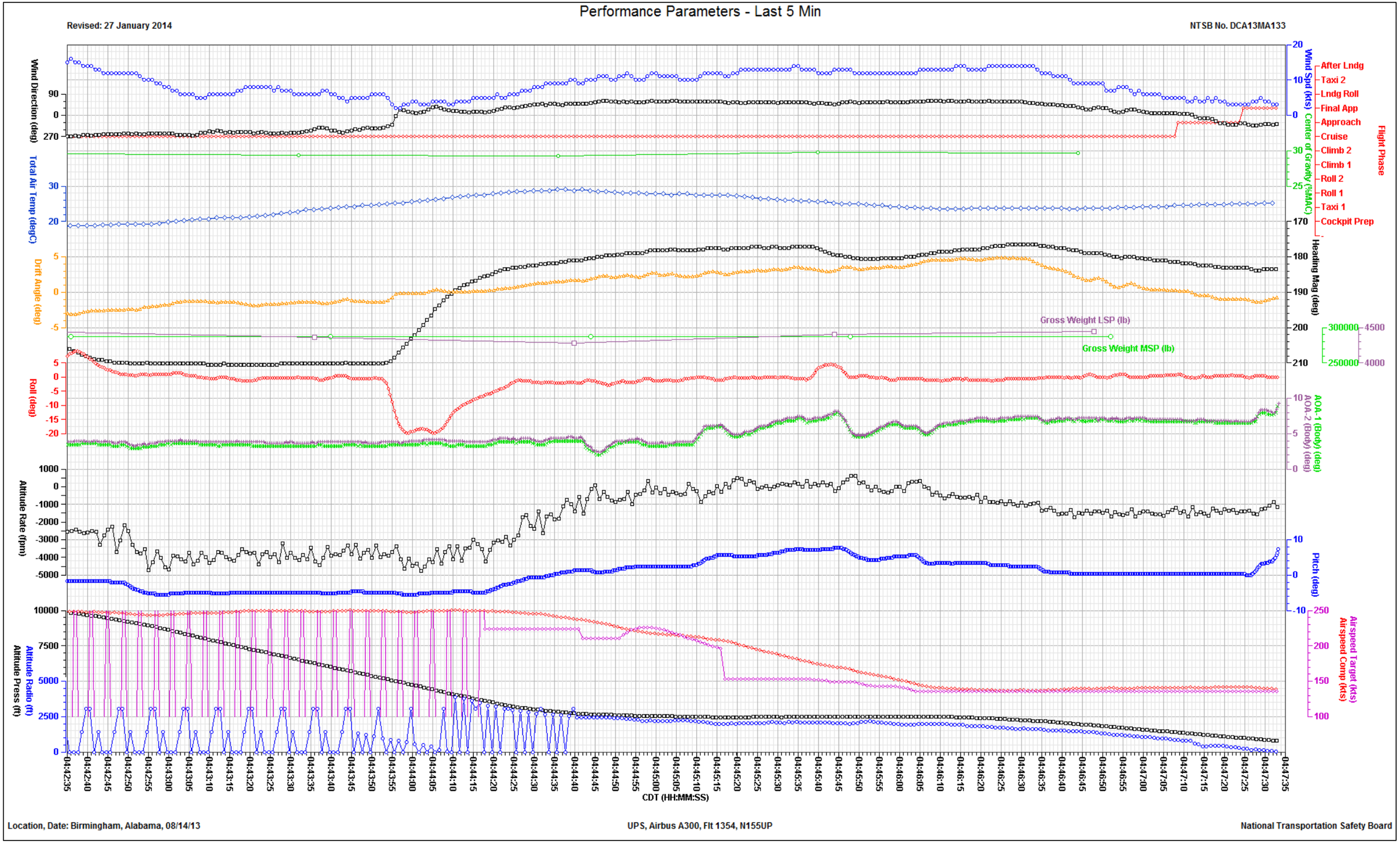

Performance Parameters - Last 5 Min
Revised: 27 January 2014
NTSB No. DCA13MA133
Wind Direction (deg)
Wind Spd (kts)
Center of Gravity (%MAC)
Flight Phase
After Lndg
Taxi 2
Lndg Roll
Final App
Approach
Cruise
Climb 2
Climb 1
Roll 2
Roll 1
Taxi 1
Cockpit Prep
Total Air Temp (degC)
Heading Mag (deg)
Drift Angle (deg)
Gross Weight LSP (lb)
Gross Weight MSP (lb)
Roll (deg)
AOA-1 (Body) (deg)
AOA-2 (Body) (deg)
Altitude Rate (fpm)
Pitch (deg)
Altitude Press (ft)
Altitude Radio (ft)
Airspeed Target (kts)
Airspeed Comp (kts)
CDT (HH:MM:SS)
Location, Date: Birmingham, Alabama, 08/14/13
UPS, Airbus A300, Flt 1354, N155UP
National Transportation Safety Board

Figure 23

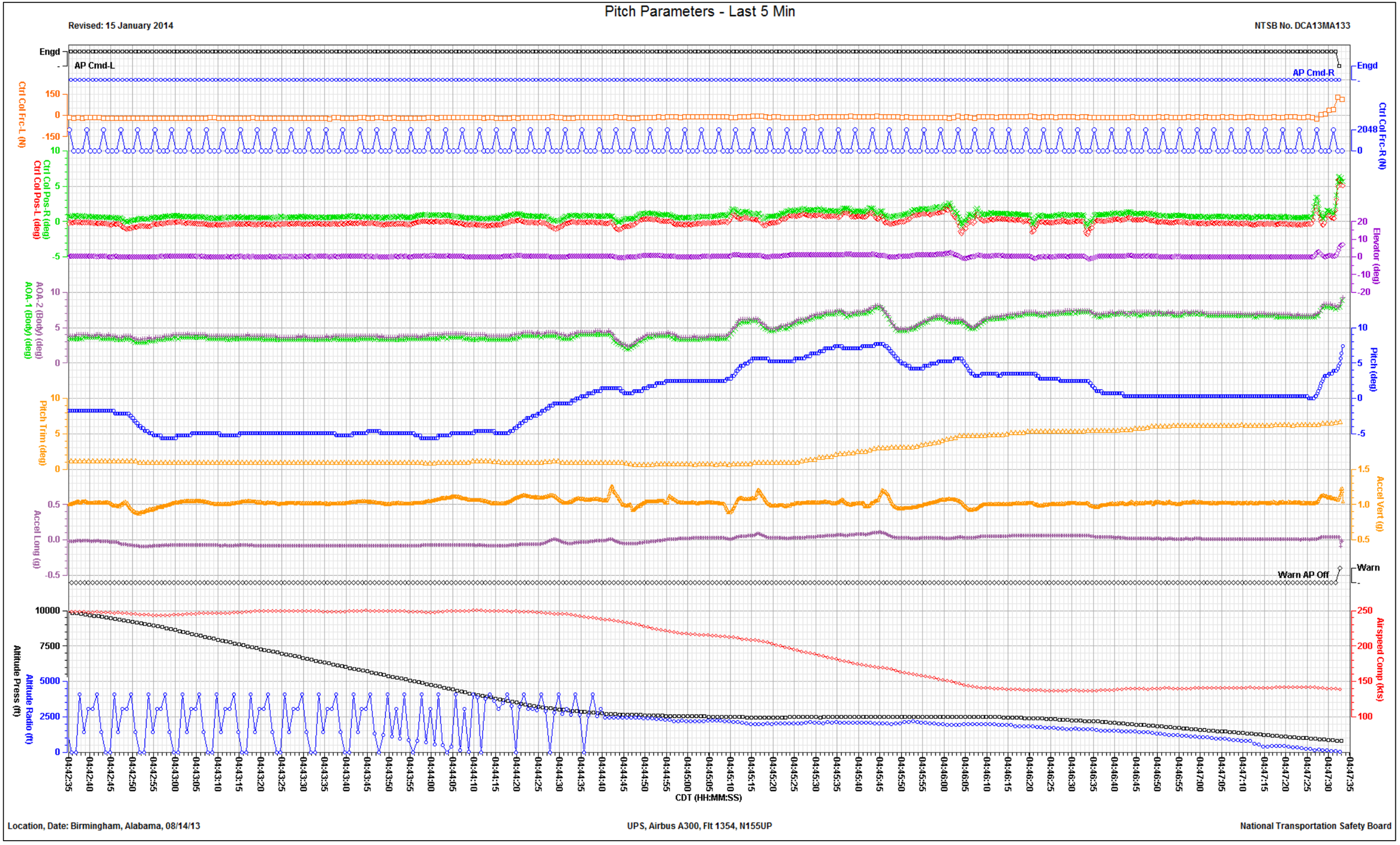

Pitch Parameters - Last 5 Min
Revised: 15 January 2014
NTSB No. DCA13MA133
Engd
AP Cmd-L
AP Cmd-R
Ctrl Col Frc-L (N)
Ctrl Col Frc-R (N)
Ctrl Col Pos-R (deg)
Ctrl Col Pos-L (deg)
Elevator (deg)
AOA-2 (Body) (deg)
AOA-1 (Body) (deg)
Pitch (deg)
Pitch Trim (deg)
Accel Vert (g)
Accel Long (g)
Warn
Warn AP Off
Altitude Press (ft)
Altitude Radio (ft)
Airspeed Comp (kts)
CDT (HH:MM:SS)
Location, Date: Birmingham, Alabama, 08/14/13
UPS, Airbus A300, Flt 1354, N155UP
National Transportation Safety Board

Figure 24

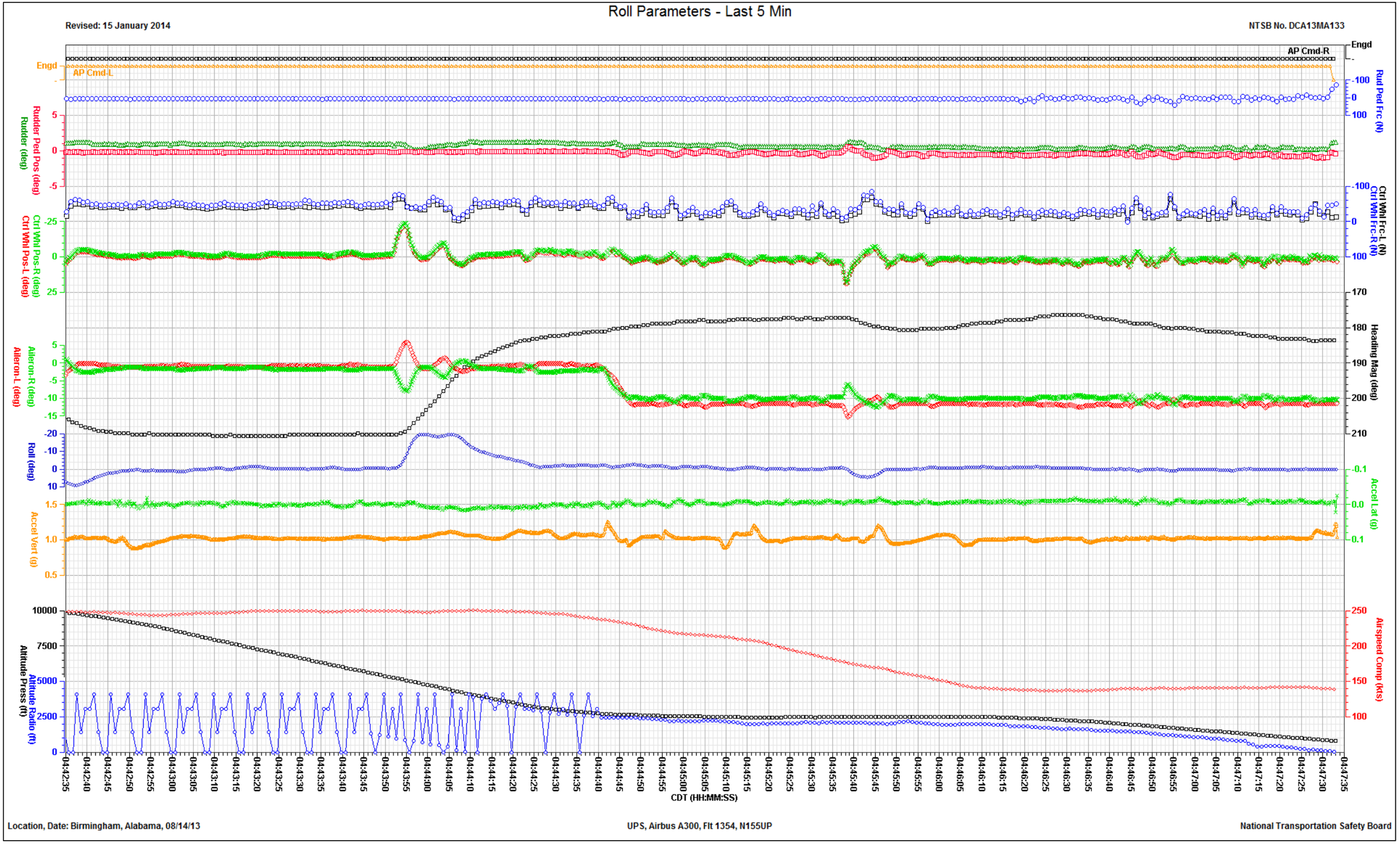

Roll Parameters - Last 5 Min
Revised: 15 January 2014
NTSB No. DCA13MA133
Engd
AP Cmd-L
AP Cmd-R
Rudder (deg)
Rudder Ped Pos (deg)
Rud Ped Frc (N)
Ctrl Whl Pos-L (deg)
Ctrl Whl Pos-R (deg)
Ctrl Whl Frc-L (N)
Ctrl Whl Frc-R (N)
Aileron-L (deg)
Aileron-R (deg)
Heading Mag (deg)
Roll (deg)
Accel Vert (g)
Accel Lat (g)
Altitude Press (ft)
Altitude Radio (ft)
Airspeed Comp (kts)
CDT (HH:MM:SS)
Location, Date: Birmingham, Alabama, 08/14/13
UPS, Airbus A300, Flt 1354, N155UP
National Transportation Safety Board

Figure 25

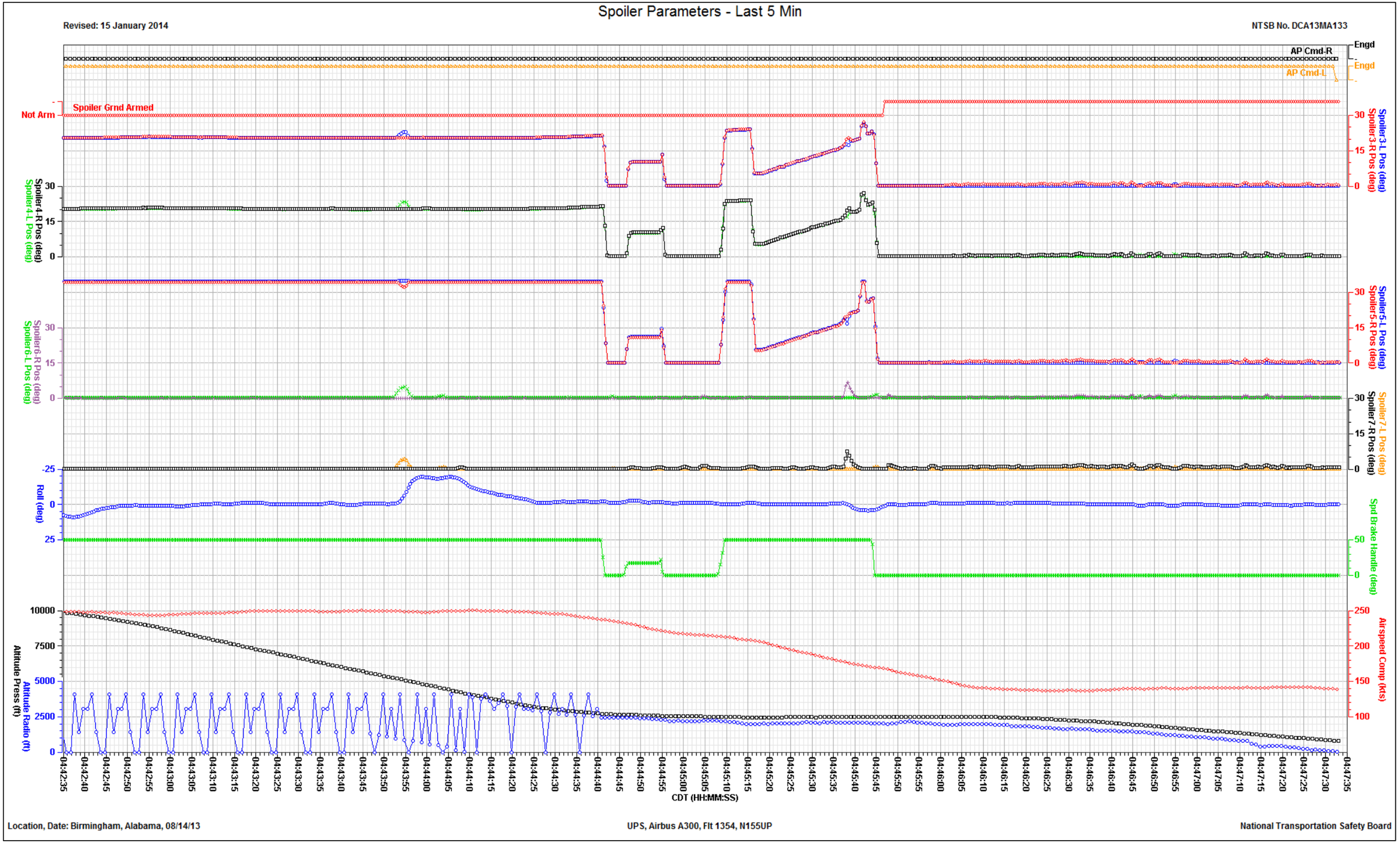
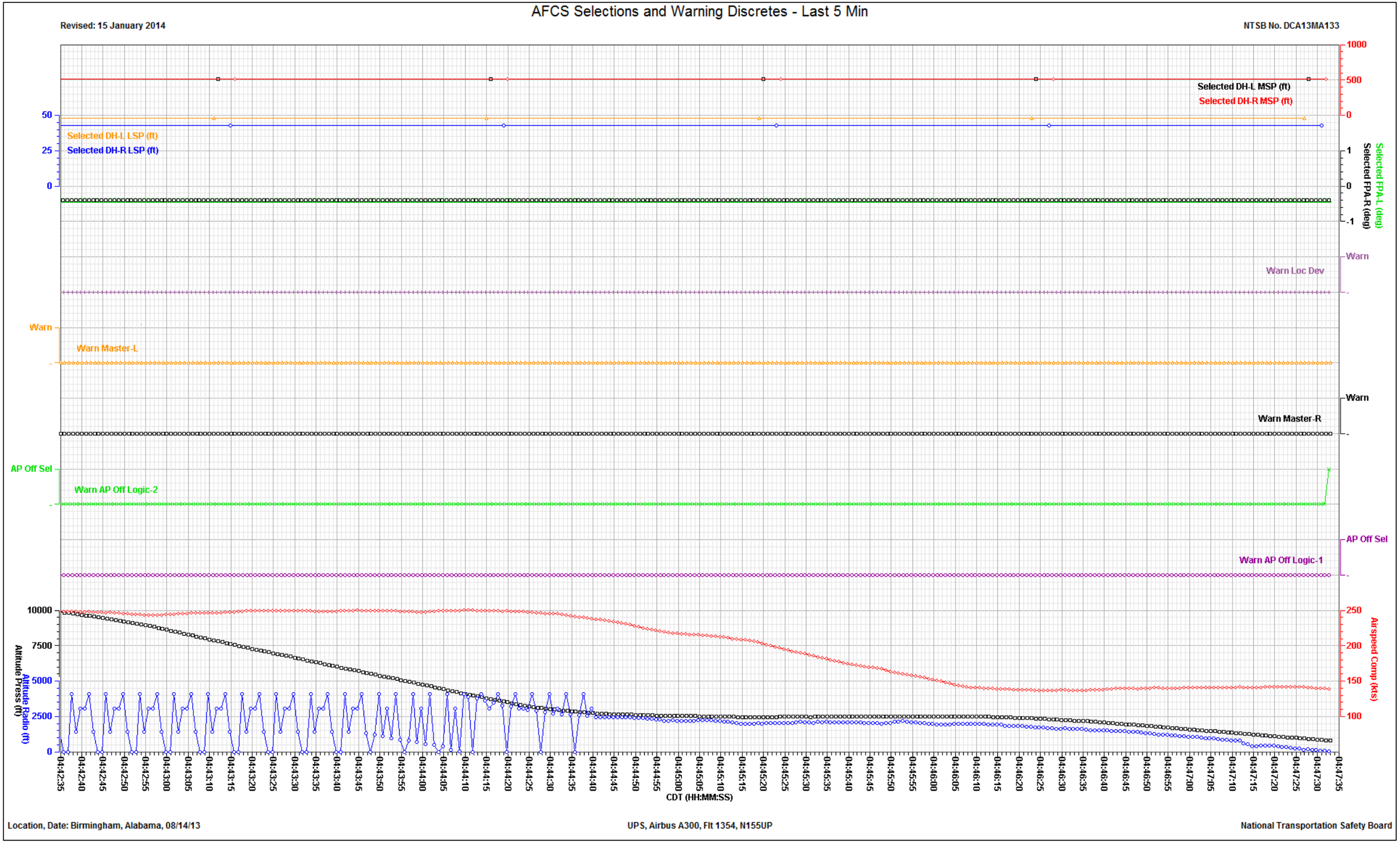

Spoiler Parameters - Last 5 Min
Revised: 15 January 2014
NTSB No. DCA13MA133
AP Cmd-R
AP Cmd-L
Engd
Spoiler Grnd Armed
Not Arm
Spoiler3-L Pos (deg)
Spoiler3-R Pos (deg)
Spoiler4-R Pos (deg)
Spoiler4-L Pos (deg)
Spoiler5-L Pos (deg)
Spoiler5-R Pos (deg)
Spoiler6-R Pos (deg)
Spoiler6-L Pos (deg)
Spoiler7-L Pos (deg)
Spoiler7-R Pos (deg)
Roll (deg)
Spd Brake Handle (deg)
Altitude Press (ft)
Altitude Radio (ft)
Airspeed Comp (kts)
CDT (HH:MM:SS)
Location, Date: Birmingham, Alabama, 08/14/13
UPS, Airbus A300, Flt 1354, N155UP
National Transportation Safety Board

Figure 26


AFCS Selections and Warning Discretes - Last 5 Min
Revised: 15 January 2014
NTSB No. DCA13MA133
Selected DH-L MSP (ft)
Selected DH-R MSP (ft)
Selected DH-L LSP (ft)
Selected DH-R LSP (ft)
Selected FPA-L (deg)
Selected FPA-R (deg)
Warn Loc Dev
Warn
Warn Master-L
Warn Master-R
AP Off Sel
Warn AP Off Logic-2
Warn AP Off Logic-1
Altitude Press (ft)
Altitude Radio (ft)
Airspeed Comp (kts)
CDT (HH:MM:SS)
Location, Date: Birmingham, Alabama, 08/14/13
UPS, Airbus A300, Flt 1354, N155UP
National Transportation Safety Board

APPENDIX A

This appendix describes the parameters provided and verified in this report. Table A-1 lists the parameters and table A-2 describes the unit abbreviations used in this report. Table A-1 contains the full parameter name, the parameter ID used in the plots and tabular data, the parameter's units (if any)[4] and a list of figures the parameters are plotted in[5].

Table A-1. Verified and provided FDR parameters.

Parameter Name	Parameter ID	Units	Figure(s)
AC Bus 1 Off	ACBus-1		16
AC Bus 2 Off	ACBus-2		16
Lateral Acceleration	Accel Lat	g	10-12, 24
Longitudinal Acceleration	Accel Long	g	10-12, 23
Vertical Acceleration	Accel Vert	g	10-12, 23
Air Data Computer 1 Fault	ADC-1 Fault		14
Air Data Computer 2 Fault	ADC-2 Fault		14
Automatic Flight Control System Lateral Modes	AFCS Lat Mode		9, 13
Automatic Flight Control System Longitudinal Modes	AFCS Long Mode		9, 14-15, 21
Left Aileron Position	Aileron-L	deg	20, 24
Right Aileron Position	Aileron-R	deg	20, 24
Computed Airspeed	Airspeed Comp	kts	9-15, 17-26
Target Airspeed	Airspeed Target	kts	22
Pressure Altitude	Altitude Press	ft	9-15, 17-26
Radio Altitude	Altitude Radio	ft	9-26
Altitude rate	Altitude Rate	fpm	22
Body Angle of Attack - 1	AOA-1 (Body)	deg	11-12, 22-23
Vane Angle of Attack -1	AOA-1 (Vane)	deg	
Body Angle of Attack - 2	AOA-2 (Body)	deg	11-12, 22-23
Vane Angle of Attack - 2	AOA-2 (Vane)	deg	
Autopilot Command - L	AP Cmd-L		9, 12-14, 20, 23-25
Autopilot Command - R	AP Cmd-R		12-14, 20, 23-25
Autopilot CWS - L	AP CWS-L		14
Autopilot CWS - R	AP CWS-R		14
Autopilot Land Track	AP Land Trk		14
Autopilot Pitch Go Around Mode	AP Pitch GA Mode		14
Autothrottle Alpha Floor Mode Engaged	AT Alpha Floor Mode		17
Autothrottle Arming Lever Off	AT Arm Lvr		17
Autothrottle Clutches Armed	AT Clutches		17
Autothrottle Mach Mode Engaged	AT Mach Mode		17
Autothrottle Manual Throttle - Armed	AT Man Throttle		17
Autothrottle Mode Engaged	AT Mode		9, 12, 17-19
Autothrottle Retard Mode Engaged	AT Retard Mode		17
Autothrottle Speed Mode Engaged	AT Speed Mode		17
Autothrottle Thrust Mode Engaged	AT Thrust Mode		17
Autothrottle VNAV Mode Engaged	AT VNAV Mode		17
Baro Corrected/Standard Altitude Selection - Capt	Baro Corr-Std Altitude Sel-L		15
Baro Corrected/Standard Altitude Selection - F/O	Baro Corr-Std Altitude Sel-R		15

[4] Most parameters without a unit description are discrete parameters. A discrete parameter is one which has 2 or more unique states with each state defined by a specific pattern of one or more bits. A few parameters, such as EPR or Mach number are ratio's or are defined such that they truly have no units.

[5] Parameters listed without a figure reference were not plotted and are only available in the tabular data, Attachment 1 to this report.

Parameter Name	Parameter ID	Units	Figure(s)
Baro Setting - Capt	Baro Set-L	mb	15
Baro Setting - F/O	Baro Set-R	mb	15
Center of Gravity	Center of Gravity	%MAC	22
Control Column Force - Capt	Ctrl Col Frc-L	N	9, 23
Control Column Force - F/O	Ctrl Col Frc-R	N	23
Control Column - Capt	Ctrl Col Pos-L	deg	9, 23
Control Column - F/O	Ctrl Col Pos-R	deg	23
Control Wheel Force - Capt	Ctrl Whl Frc-L	N	24
Control Wheel Force - F/O	Ctrl Whl Frc-R	N	24
Control Wheel - Capt	Ctrl Whl Pos-L	deg	24
Control Wheel - F/O	Ctrl Whl Pos-R	deg	24
DME 1 Frequency	DME 1 Freq	MHz	15
DME1/ILS	DME 1 ILS	nm	9-10, 15
DME 1/VOR	DME 1 VOR	nm	
DME 2 Frequency	DME 2 Freq	MHz	15
DME2/ILS	DME 2 ILS	nm	9-10, 15
DME 2/VOR	DME 2 VOR	nm	
Drift Angle	Drift Angle	deg	22
EEC 1 Fault	EEC-1 Fault		19
EEC 2 Fault	EEC-2 Fault		19
EGPWS Caution Obstacle	EGPWS Caut Obst		16
EGPWS Caution Terrain	EGPWS Caut Terr		16
EGPWS Don't Sink	EGPWS Don't Sink		16
EGPWS Glideslope	EGPWS Glideslope		16
EGPWS Obstacle	EGPWS Obstacle		16
EGPWS Pull Up	EGPWS Pull Up		16
EGPWS Sink Rate	EGPWS Sinkrate		9-10, 16
EGPWS Terrain Ahead	EGPWS Terr Ahead		16
EGPWS Terrain Ahead Pull Up	EGPWS Terr Ahead Pull Up		16
EGPWS Terrain	EGPWS Terrain		16
EGPWS Terrain Mode Off	EGPWS Terr Mode Off		16
Terrain on Capt Navigational Display	EGPWS Terr on ND-L		16
Terrain on F/O Navigational Display	EGPWS Terr on ND-R		16
EGPWS Too Low - Flaps	EGPWS Too Low Flaps		16
EGPWS Too Low - Gear	EGPWS Too Low Gear		16
EGPWS Too Low - Terrain	EGPWS Too Low Terrain		16
Elevator Position	Elevator	deg	23
Engine 1 - Bleed Valve Open	Eng1 Bld Vlv Pos		19
Engine 1 - Burner Pressure	Eng1 Burner Press	psia	18
Engine 1 - Exhaust Gas Temperature	Eng1 EGT	degC	17-18
Engine 1 - Actual Engine Pressure Ratio	Eng1 EPR Actual		9, 11-12, 17-19
Engine 1 - Commanded Engine Pressure Ratio	Eng1 EPR Cmd		11-12, 17-19
Engine 1 - Engine Vibration Monitoring - Fan	Eng1 EVM Fan	units	18
Engine 1 - Engine Vibration Monitoring - Turbine	Eng1 EVM Turb	units	
Engine 1 - Fire	Eng1 Fire		19
Engine 1 - Fuel Flow	Eng1 Fuel Flow	kgph	18
Engine 1 - High Pressure Bleed Valve Not Fully Closed	Eng1 HP Bld Vlv		19
Engine 1 - Low Oil Pressure	Eng1 Low Oil Press		19
Engine 1 - Actual N1	Eng1 N1 Actual	%RPM	17-19
Engine 1 - Actual N2	Eng1 N2 Actual	%RPM	17-19
Engine 1 - Oil Pressure	Eng1 Oil Press	psi	19
Engine 1 - Oil Temperature	Eng1 Oil Temp	degC	19
Engine 1 - EGT, N1, or N2 Over Limit	Eng1 Ovr Lmt		19
Engine 1 - Throttle Resolver Angle	Eng1 TRA	deg	9, 12, 17-18
Engine 1 - Thrust Reverser Extended	Eng1 TR Ext		18

Parameter Name	Parameter ID	Units	Figure(s)
Engine 1 - Thrust Reverser Unlocked	Eng1 TR Unlk		18
Engine 2 - Bleed Valve Open	Eng2 Bld Vlv Pos		19
Engine 2 - Burner Pressure	Eng2 Burner Press	psia	18
Engine 2 - Exhaust Gas Temperature	Eng2 EGT	degC	17-18
Engine 2 - Actual Engine Pressure Ratio	Eng2 EPR Actual		9, 11-12, 17-19
Engine 2 - Commanded Engine Pressure Ratio	Eng2 EPR Cmd		11-12, 17-19
Engine 2 - Engine Vibration Monitoring - Fan	Eng2 EVM Fan	units	18
Engine 2 - Engine Vibration Monitoring - Turbine	Eng2 EVM Turb	units	
Engine 2 - Fire	Eng2 Fire		19
Engine 2 - Fuel Flow	Eng2 Fuel Flow	kgph	18
Engine 2 - High Pressure Bleed Valve Not Fully Closed	Eng2 HP Bld Vlv		19
Engine 2 - Low Oil Pressure	Eng2 Low Oil Press		19
Engine 2 - Actual N1	Eng2 N1 Actual	%RPM	17-19
Engine 2 - Actual N2	Eng2 N2 Actual	%RPM	17-19
Engine 2 - Oil Pressure	Eng2 Oil Press	psi	19
Engine 2 - Oil Temperature	Eng2 Oil Temp	degC	19
Engine 2 - EGT, N1, or N2 Over Limit	Eng2 Ovr Lmt		19
Engine 2 - Throttle Resolver Angle	Eng2 TRA	deg	9, 12, 17-18
Engine 2 - Thrust Reverser Extended	Eng2 TR Ext		18
Engine 2 - Thrust Reverser Unlocked	Eng2 TR Unlk		18
Flap Lever Position	Flap Lvr Pos	detent	20
Flap Position	Flaps	deg	10, 20
Flight Path Angle	Flight Path Angle	deg	
Phase of Flight	Flight Phase		22
Left Flight Director Engaged	Flt Dir-L		14
Right Flight Director Engaged	Flt Dir-R		14
Left Main Landing Gear Down and Locked	Gear Dn+Lock-L		10, 20
Nose Landing Gear Down and Locked	Gear Dn+Lock-N		10, 20
Right Main Landing Gear Down and Locked	Gear Dn+Lock-R		10, 20
Gear Selector Down	Gear Hndl Dn		20
Gear Selector Up	Gear Hndl Up		20
Left Main Landing Gear Weight-on-Wheels	Gear WOW-L		20
Nose Landing Gear Weight-on-Wheels	Gear WOW-N		20
Right Main Landing Gear Weight-on-Wheels	Gear WOW-R		20
Gross Weight - Least Significant Part	Gross Weight LSP	lb	22
Gross Weight - Most Significant Part	Gross Weight MSP	lb	22
Ground Speed	Ground Spd	kts	15
Magnetic Heading	Heading Mag	deg	11-13, 22, 24
ILS/MMR 1 Frequency	ILS-MMR Freq-1	MHz	13
ILS/MMR 2 Frequency	ILS-MMR Freq-2	MHz	13
VHF-1 Radio Keying	Key VHF-1		
VHF-2 Radio Keying	Key VHF-2		
VHF-3 Radio Keying	Key VHF-3		
Latitude - 1	Latitude-1	deg	21
Latitude - 2	Latitude-2	deg	21
Localizer 1 Deviation	Loc Dev-1	dots	9, 13
Localizer 2 Deviation	Loc Dev-2	dots	9, 13
Longitude - 1	Longitude-1	deg	21
Longitude - 2	Longitude-2	deg	21
MMR 1 Mode	MMR 1 Mode		21
MMR 2 Mode	MMR 2 Mode		21
Navigation Accuracy	Nav Accuracy		21
Navigation Modes	Nav Modes		21
Navigation Display Format - Capt	ND Disp Fmt-L		15
Navigation Display Format - F/O	ND Disp Fmt-R		15

Parameter Name	Parameter ID	Units	Figure(s)
Navigation Display Range - Capt	ND Disp Rng-L	nm	15
Navigation Display Range - F/O	ND Disp Rng-R	nm	15
Navigation Function Displayed - Capt	ND Func Disp-L		15
Navigation Function Displayed - F/O	ND Func Disp-R		15
Origin Page Called	Origin Page Called		21
Pitch Attitude	Pitch	deg	9-12, 14, 17-19, 22-23
Pitch Trim Position	Pitch Trim	deg	23
Radar Operating Mode - Capt	Radar Mode-L		21
Radar Operating Mode - F/O	Radar Mode-R		21
Roll Attitude	Roll	deg	11-13, 22, 24-25
Rudder Position	Rudder	deg	24
Rudder Pedal	Rudder Ped Pos	deg	24
Rudder Pedal Force	Rud Ped Frc	N	24
Selected Airspeed	Selected Airspd	kts	9, 14
Selected Altitude - Manual	Selected Alt Man	ft	9, 14
Selected Decision Height - Capt - Least Significant Part	Selected DH-L LSP	ft	26
Selected Decision Height - Capt - Most Significant Part	Selected DH-L MSP	ft	26
Selected Decision Height - F/O - Least Significant Part	Selected DH-R LSP	ft	26
Selected Decision Height - F/O - Most Significant Part	Selected DH-R MSP	ft	26
Selected Flight Path Angle - Capt	Selected FPA-L	deg	26
Selected Flight Path Angle - F/O	Selected FPA-R	deg	26
Selected Heading	Selected Head	deg	13
Selected Vertical Speed	Selected Vert Spd	fpm	9, 14
Slat Position	Slats	deg	10, 20
Slat Lever Position SFCC 1	Slats Lvr Pos SFCC 1	detent	20
Slat Lever Position SFCC 2	Slats Lvr Pos SFCC 2	detent	20
Speed Brake Handle Position	Spd Brake Handle	deg	10, 20, 25
Spoiler 1L Retracted	Spoiler1-L Retracted		20
Spoiler 1R Retracted	Spoiler1-R Retracted		20
Spoiler 2L Retracted	Spoiler2-L Retracted		20
Spoiler 2R Retracted	Spoiler2-R Retracted		20
Spoiler 3L Position	Spoiler3-L Pos	deg	10, 25
Spoiler 3R Position	Spoiler3-R Pos	deg	10, 25
Spoiler 4L Position	Spoiler4-L Pos	deg	10, 25
Spoiler 4R Position	Spoiler4-R Pos	deg	10, 25
Spoiler 5L Position	Spoiler5-L Pos	deg	10, 25
Spoiler 5R Position	Spoiler5-R Pos	deg	10, 25
Spoiler 6L Position	Spoiler6-L Pos	deg	10, 25
Spoiler 6R Position	Spoiler6-R Pos	deg	10, 25
Spoiler 7L Position	Spoiler7-L Pos	deg	10, 25
Spoiler 7R Position	Spoiler7-R Pos	deg	10, 25
Ground Spoiler Armed	Spoiler Grnd Armed		10, 20, 25
GMT - Hours	Time GMT Hrs	hrs	
GMT - Minutes	Time GMT Min	min	
GMT - Seconds	Time GMT Sec	sec	
Total Air Temperature	Total Air Temp	degC	22
Vertical Deviation - 1	Vert Dev-1	ft	21
Vertical Deviation - 2	Vert Dev-2	ft	21
Vertical Speed	Vert Spd	fpm	9, 14, 16
VOR 1 Bearing	VOR 1 Bearing	deg	21
VOR 1 Frequency	VOR 1 Freq	MHz	21
VOR 2 Bearing	VOR 2 Bearing	deg	21
VOR 2 Frequency	VOR 2 Freq	MHz	21
Autopilot Off Warning	Warn AP Off		9, 23
Autopilot Off Warning Logic - 1	Warn AP Off Logic-1		26

Parameter Name	Parameter ID	Units	Figure(s)
Autopilot Off Warning Logic - 2	Warn AP Off Logic-2		26
Localizer Deviation Warning	Warn Loc Dev		26
Master Warning - Capt	Warn Master-L		26
Master Warning - F/O	Warn Master-R		26
Wind Direction	Wind Direction	deg	22
Wind Speed	Wind Spd	kts	22
Yaw Damper 1 Fault	Yaw Damper 1 Fault		13
Yaw Damper 2 Fault	Yaw Damper 2 Fault		13

Table A-2. Unit abbreviations.

Units Abbreviation	Description
%MAC	percent of mean aerodynamic chord
%RPM	percent of maximum revolutions per minute
deg	degrees
degC	degrees Celsius
detent	detent
dots	dots
fpm	feet per minute
ft	feet
g	g
hrs	hours
kgph	kilograms per hour
kts	knots
lb	pounds
mb	millibars
MHz	megahertz
min	minutes
N	newton
nm	nautical miles
psi	pounds per square inch
psia	pounds per square inch absolute
sec	seconds
units	units