

NATIONAL TRANSPORTATION SAFETY BOARD

Vehicle Recorder Division

Washington, D.C. 20594

September 24, 2020

Flight Data Recorder

Specialist's Factual Report

By Kyle Garner

1. EVENT SUMMARY

Location: New York, New York
Date: September 06, 2018
Aircraft: Boeing 757-200
Registration: N173AN
Operator: American Airlines
NTSB Number: DCA18LA285

On September 6, 2018, at about 1245 eastern daylight time (EDT), American Airlines flight 279, a Boeing 757-200, registration N173AN, experienced an abrupt maneuver while descending into John F. Kennedy International Airport (KJFK), Jamaica, New York. Of the 113 passengers and crew onboard, one flight attendant received serious injuries. The airplane was not damaged. The regularly scheduled international passenger flight was operating under the provisions of Title 14 *Code of Federal Regulations (CFR)* Part 121 from Edinburgh Airport (EGPH), Edinburgh, Scotland, to KJFK.

2. FLIGHT DATA RECORDER GROUP

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

3. FDR CARRIAGE REQUIREMENTS

The event aircraft, N173AN, was manufactured in March 2002 and was operating such that it was required to be equipped with an FDR that recorded, at a minimum, 57 parameters, as cited in CFR 121.344(e).

4. DETAILS OF FDR INVESTIGATION

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

Recorder Manufacturer/Model: **L-3/Fairchild FA2100, 256 wps**
Recorder Serial Number: **01166**

Recorder Manufacturer/Model: **PCMCIA Card, 256 wps**
Recorder Serial Number: **CAR9607/AGS4426**

4.1. L-3/Fairchild FA2100 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 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.

4.1.1. L-3/Fairchild FA2100 Recorder Condition

The recorder was in good condition and the data were extracted normally from the recorder using manufacturer instructions and NTSB lab equipment.

4.1.2. L-3/Fairchild FA2100 Recording Description

The FDR recording contained approximately 50 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 7 hours and 32 minutes. The parameters evaluated for the purpose of this report appeared to be in accordance with federal FDR carriage requirements.

4.2. PCMCIA Card Description

The PCMCIA card is a storage and transfer medium for Flight Operations Quality Assurance (FOQA) program data. It is configured to record the same data provided to the L-3/Fairchild FA2100 FDR and thus provides a redundant, not crash protected, copy of FDR data for the aircraft. The PCMCIA card recording duration may be longer than that of the required crash protected FDR. It primarily functions as quick access media for transferring data from completed flights to ground processing stations.

4.2.1. PCMCIA Card Condition

The PCMCIA card was in good condition and the files were downloaded using normal procedures.

4.2.2. PCMCIA Card Recording Description

The PCMCIA card contained approximately 50 hours of data. The data was evaluated and found to be a duplicate set of the L-3/Fairchild FA2100 data. No further review of the PCMCIA card data was conducted.

4.3. 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.

4.4. Pressure Altitude

This FDR records pressure altitude, which is based on a standard altimeter setting of 29.92 inches of mercury (in Hg). The 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.

4.5. Time Correlation

Correlation of the FDR data from SRN to Coordinated Universal Time (UTC) was established by using the recorded Time GMT² hours, Time GMT Minutes, and Time GMT Seconds.

Accordingly, the time offset for the event flight data from SRN to UTC is the following:

UTC = SRN - 116,106.

Therefore, for the rest of this report, all times are referenced as UTC, not SRN.

4.6. FDR Plots and Corresponding Tabular Data

Figures 1 to 9 contain FDR data recorded during the event on September 6, 2018. All the parameters listed in table A-1 are plotted or provided in tabular format. Most of the plots are grouped into sets of parameters which are plotted for three different time ranges from the incident flight. The time ranges are:

- Full Incident Flight – covers the complete incident flight from 09:25:00 to the arrival at KJFK at approximately 17:01:20
- Descent – beginning at 16:38:00 and covers the descent from 24,000 feet, through the event at approximately 16:47:45, and two minutes and fifteen seconds after the event to 16:50:00
- Event – covers the three minutes surrounding the event from 16:46:00 to 16:49:00

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.

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 UTC.

Below approximately 30 knots, when the aircraft was on the ground, the computed airspeed parameter recorded a non-computed data (NCD) pattern which is expected normal behavior and indicative that the raw data was no longer reliable or not available.

The right control wheel position parameter had an approximate 13-degree offset from the left control wheel position for the entire flight. The source or cause of this offset is unknown, and the data are shown uncorrected.

Many parameters (including magnetic heading, pitch, roll, ground speed, autopilot discretes) have multiple sources (left, right, center FCC/IRU/EFIS). The data from parameters with multiple sources were compared and if the data was identical, only data from once source is plotted. Data from all sources is provided in the tabular data as attachment 1 to this report.

Figures 1 to 3 show a basic parameter set which includes aircraft accelerations (lateral, longitudinal, and vertical), attitude (pitch and roll), heading, air and ground speeds, autopilot and auto throttle engagement, engine fan speeds (N1), and altitude.

Figures 4 to 6 show a set of parameters related to the autopilot and auto throttle systems including mode selections and engagement status. Altitude, pitch attitude, and airspeed are also shown for reference.

Figures 7 to 9 show a set of parameters related to flight control surfaces including flight control surface positions (rudder, aileron, elevator, and horizontal stabilizer), flight control inputs (control column and control wheel positions), pitch and roll attitudes, engine throttle lever angles, and autotrim commands. Altitude, airspeed, and the position of the seat belt sign switch are also shown for reference.

The data show that the aircraft departed EGPB at 09:28:24 and climbed to a cruising altitude of 36,000 feet. Autopilot and auto throttle were engaged after takeoff and remained engaged until the event. The aircraft cruised at or near 36,000 feet until an initial descent to 24,000 feet into KJFK began at approximately 16:31:50. At 16:37:49 the aircraft reached 24,000 feet and held at that altitude for about a minute until 12,000 feet was dialed into the mode control panel (MCP) at 16:39:04 and another descent began.

During the descent to 12,000 feet the auto throttle system was engaged in IAS mode, the autopilot vertical guidance varied between VNAV and vertical speed (V/S) mode engaged, and the autopilot lateral guidance had LNAV engaged. The altimeter was set to 29.92 inHg.

As the aircraft neared 12,000 feet, at 16:45:39 Altitude Hold mode engaged. 16 seconds later, at 16:45:55, the recorded altimeter setting changed from 29.92 inHg to 30.13 inHg (Note: the altimeter setting is only recorded once every four seconds, so the input change may have occurred any time between 16:45:51 and 16:45:55).

At 16:45:55 the flight change (FLCH) button was activated on the MCP and the auto throttle system immediately transitioned to FLCH descent mode. Immediately after engagement of this mode the MCP speed window switched to display the current airspeed, slightly above the flight crew's desired 250 knots. The MCP speed was then manually dialed down to 250 knots, the engine throttle lever angle began to decrease (indicating the throttles were moving

aft) and the airplane decelerated. Once the throttles reached the aft stop, the auto throttle system entered Throttle Hold mode.

With the autopilot in FLCH mode with a target altitude of 12,000 feet and the auto throttles in Throttle Hold mode, aircraft pitch attitude began to increase to attempt to hold 12,000 feet and airspeed started to decay below 250 knots. At 16:47:31, airspeed had degraded to 186.5 knots and the pitch attitude was approximately 6 deg nose up. Three seconds later, at 16:47:34 and an airspeed of 185.5 knots, throttle lever angles increased rapidly, and the auto throttle system exited Throttle Hold mode. N1 on both engines began to increase.

At 16:47:42, the autopilot and auto throttle systems were disengaged. Throttle lever angles began to decrease. Airspeed was 195 knots and increasing. Two seconds later, at 16:47:44, aircraft pitch attitude was approximately 10 degrees nose up and the control column position moved quickly forward (to command nose down attitude). From 16:47:44 to 16:47:55 vertical acceleration varied between 1.476 g and -0.156 g and pitch attitude varied between 10 degrees nose up and 3 degrees nose down.

Following the event, the auto throttle system was briefly engaged again at 16:48:01 and disengaged at 16:48:08. The aircraft continued to gain airspeed. Pressure altitude was 11149 feet and decreasing. At 16:48:16 the autopilot was reengaged with a target altitude of 7,000 feet. The auto throttle system remained disengaged until 16:49:31. The aircraft then landed on runway 22L at KJFK at 17:00:35, approximately 13 minutes following the event.

The corresponding tabular data used to create figures 1 to 9, including Time GMT Hours, Time GMT Minutes, and Time GMT Seconds, are provided compressed in electronic comma separated value (*.csv) format as attachment 1 to this report.

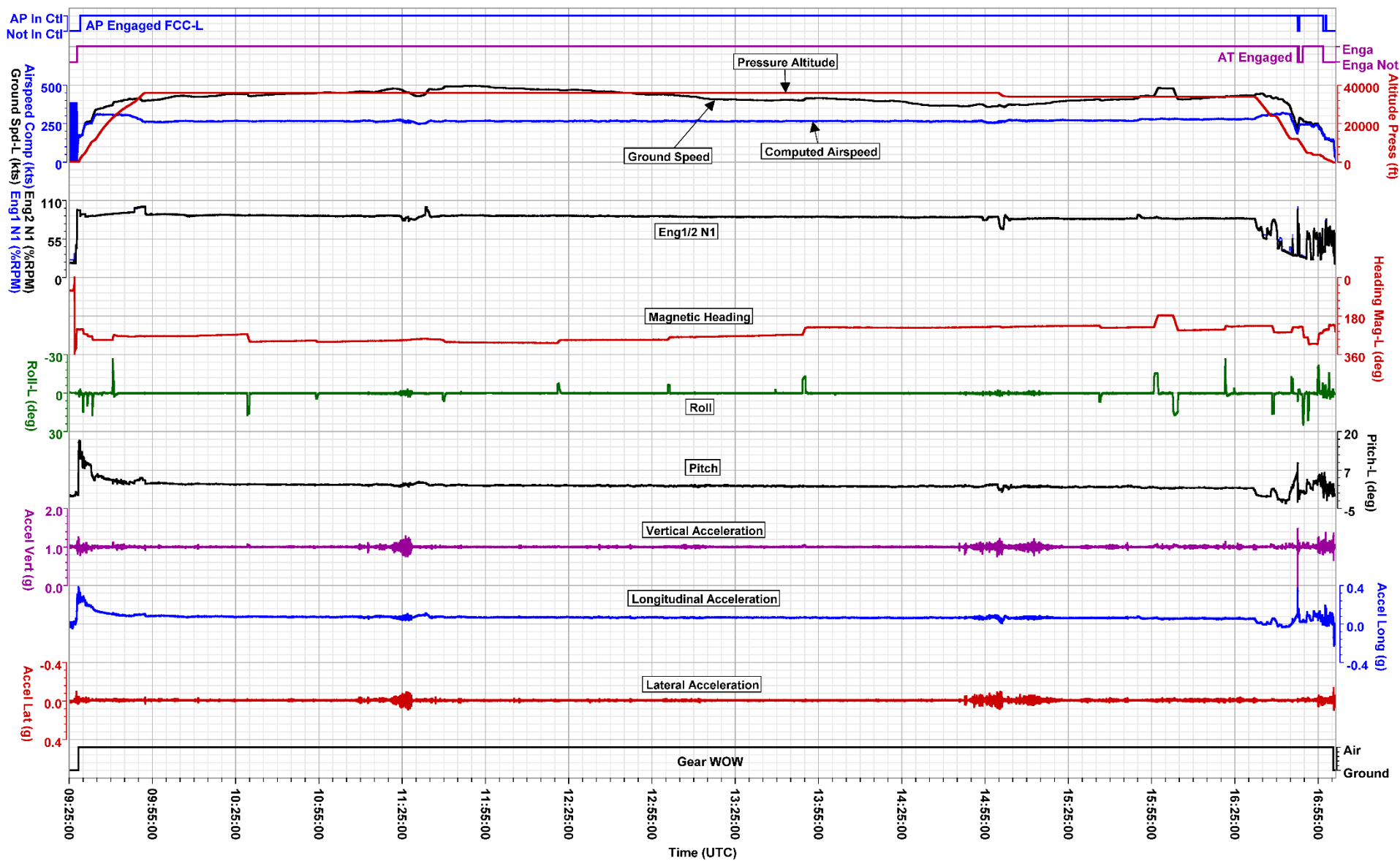


Figure 1. Plot of Basic Parameters for Full Incident Flight.

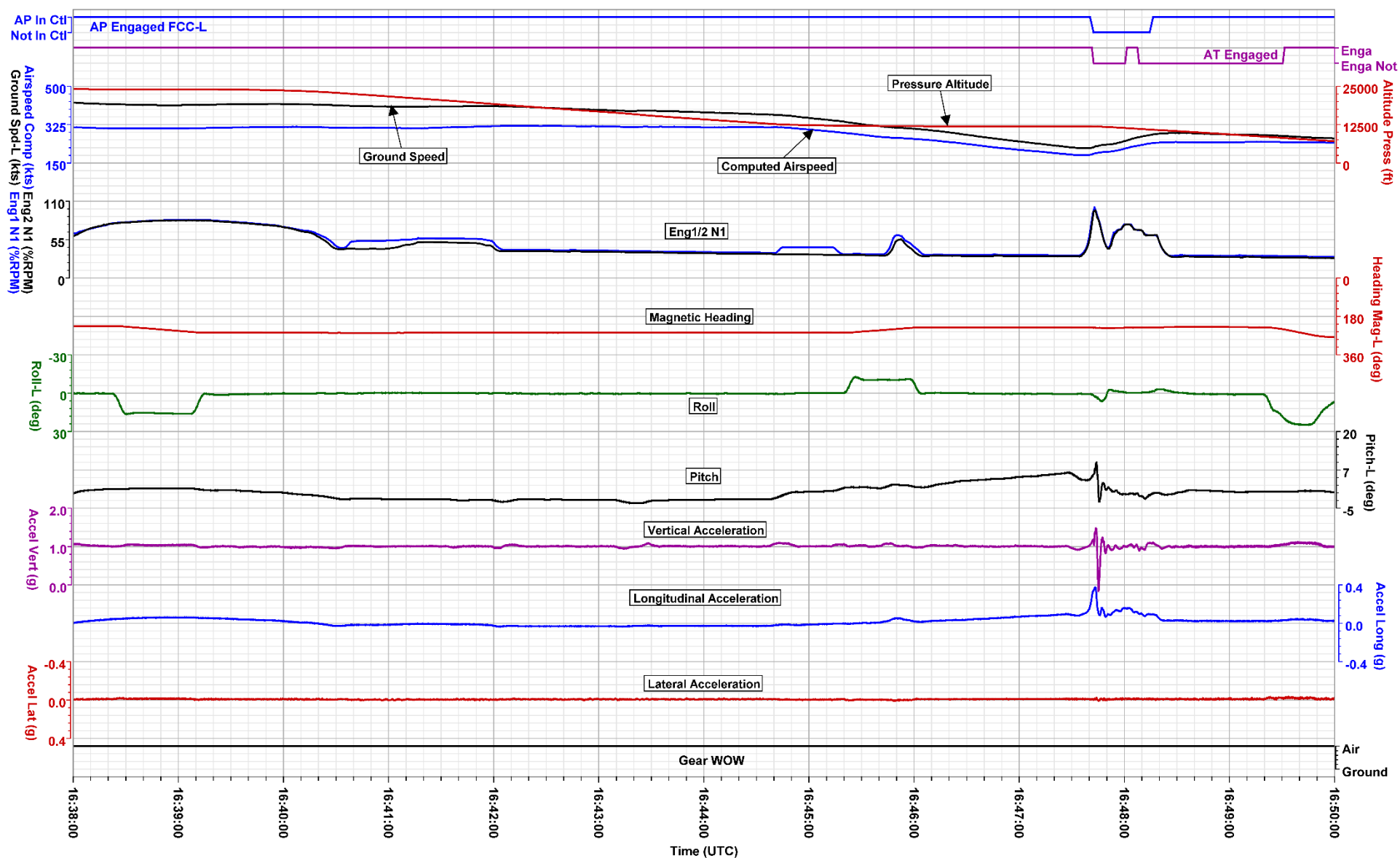


Figure 2. Plot of Basic Parameters During Descent.

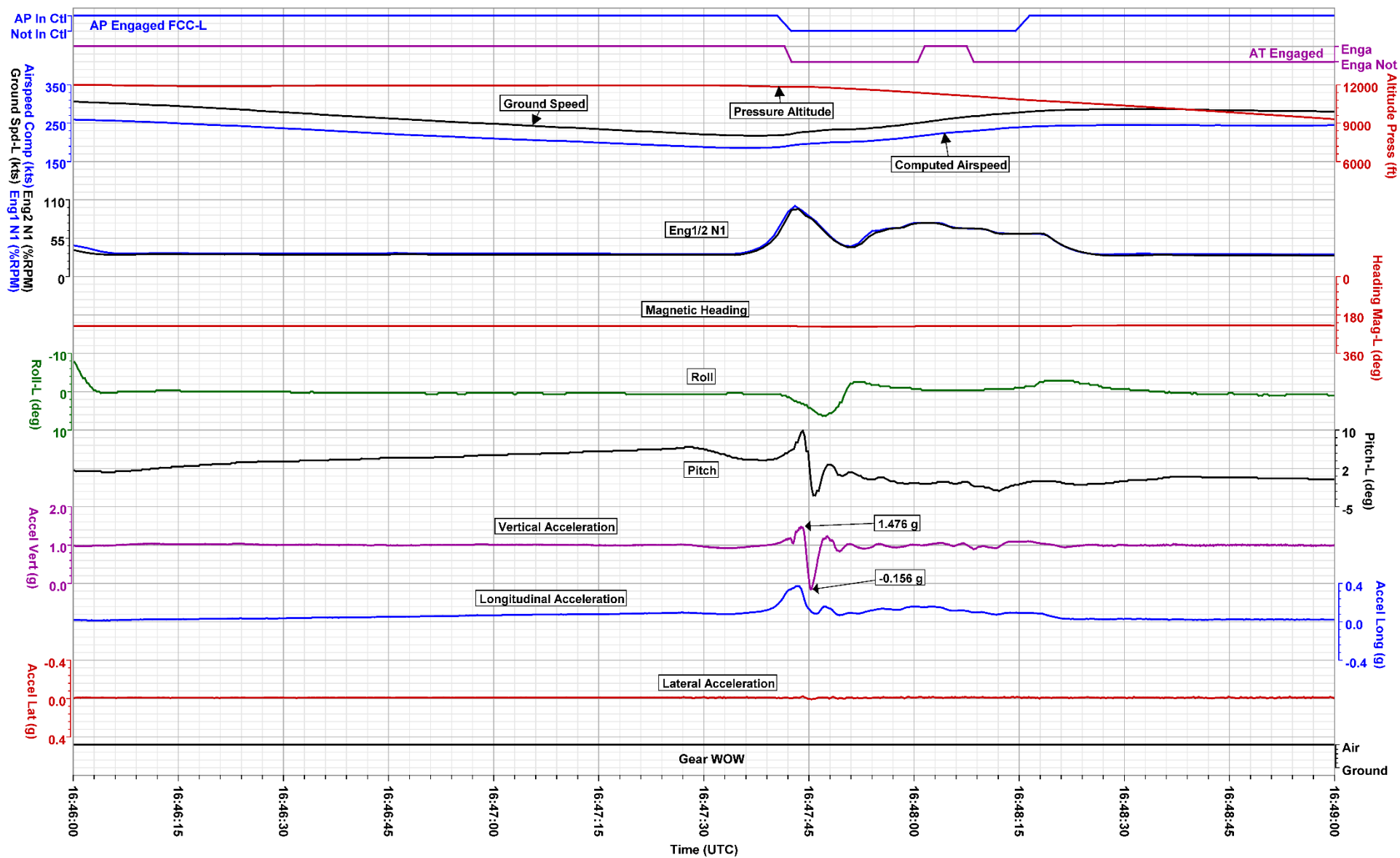


Figure 3. Plot of Basic Parameters During Event.

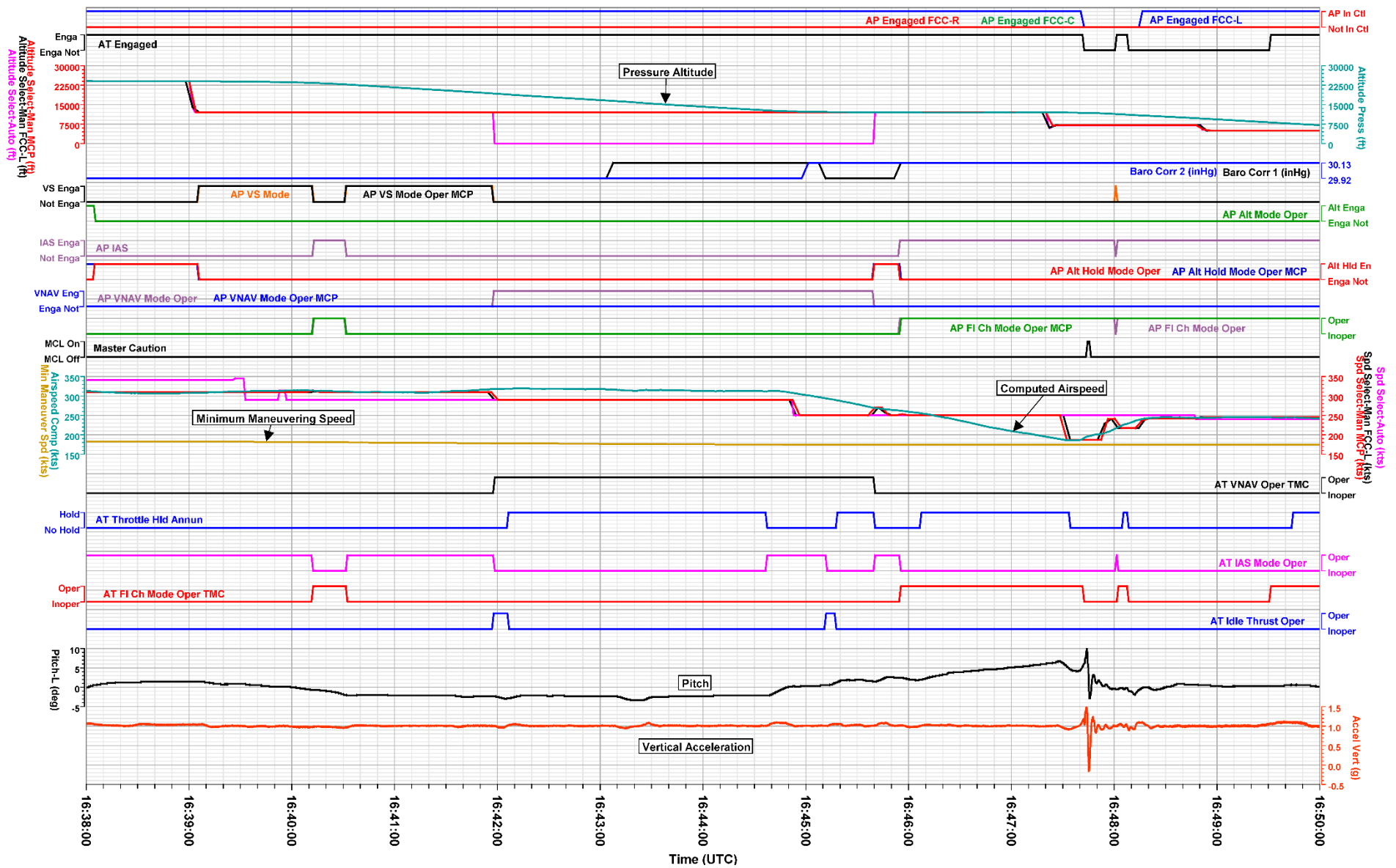


Figure 5. Plot of Autopilot Parameters During Descent.

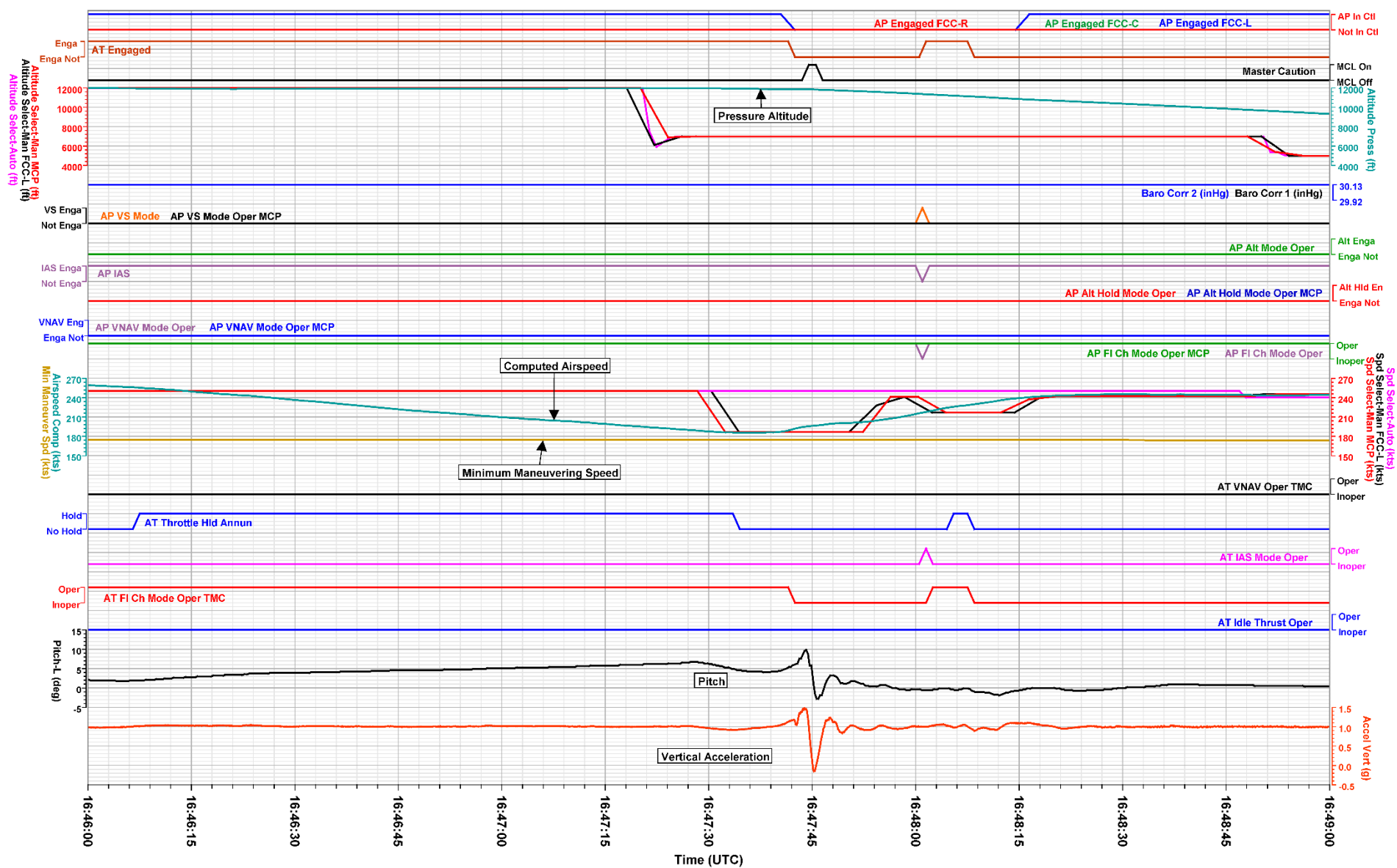


Figure 6. Plot of Autopilot Parameters During Event.

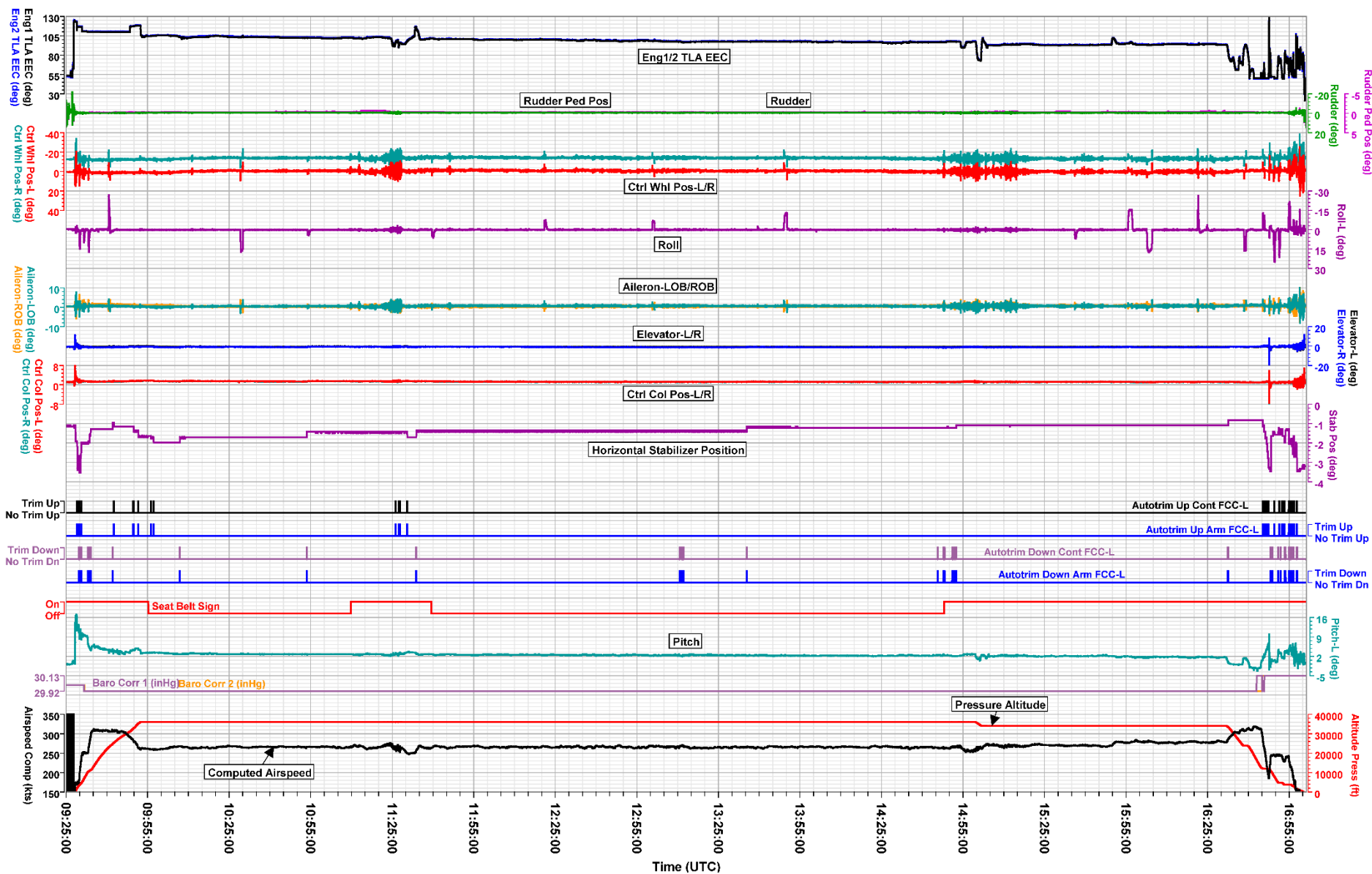


Figure 7. Plot of Flight Control Parameters for Full Incident Flight.

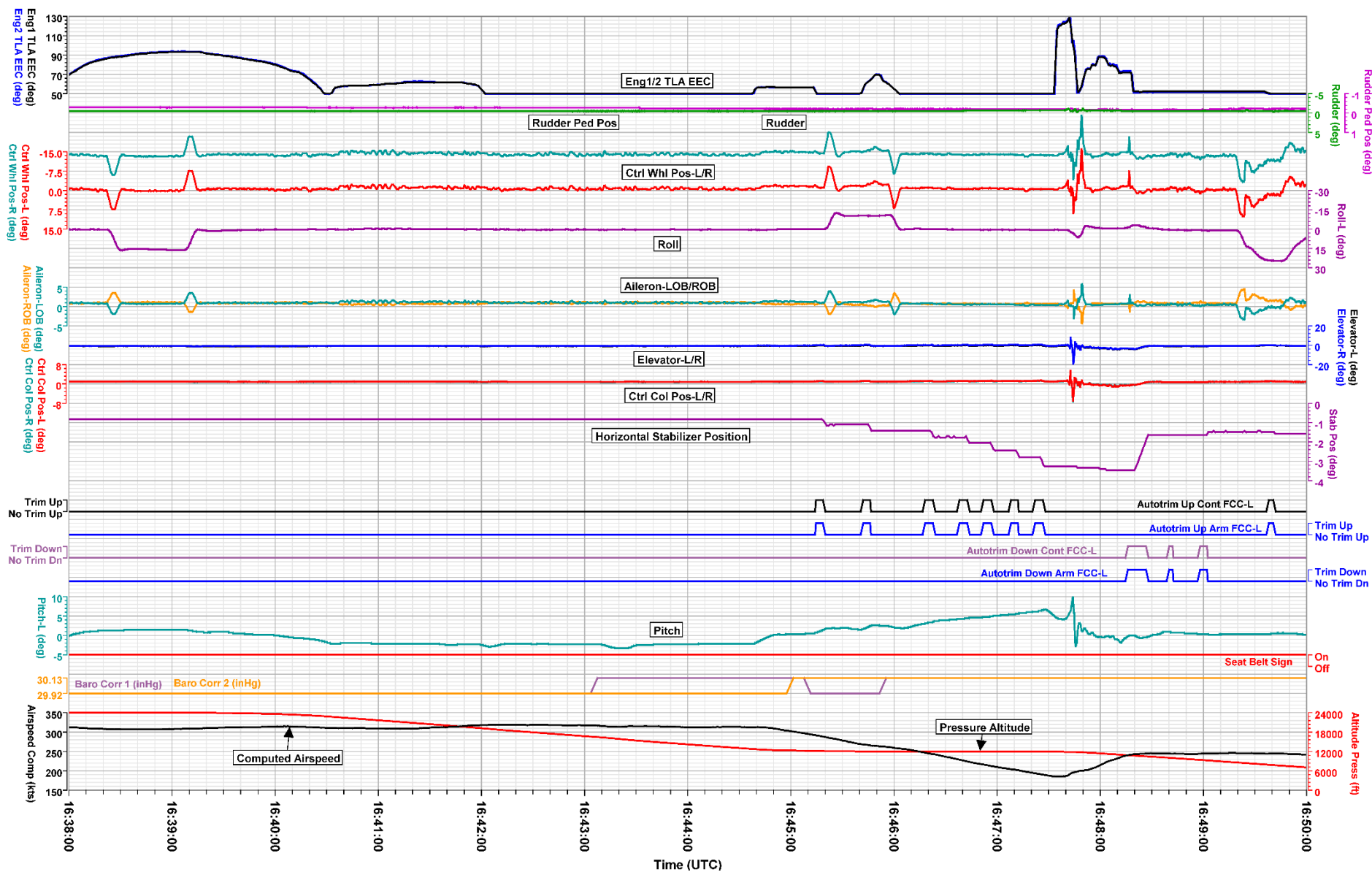


Figure 8. Plot of Flight Control Parameters During Descent.

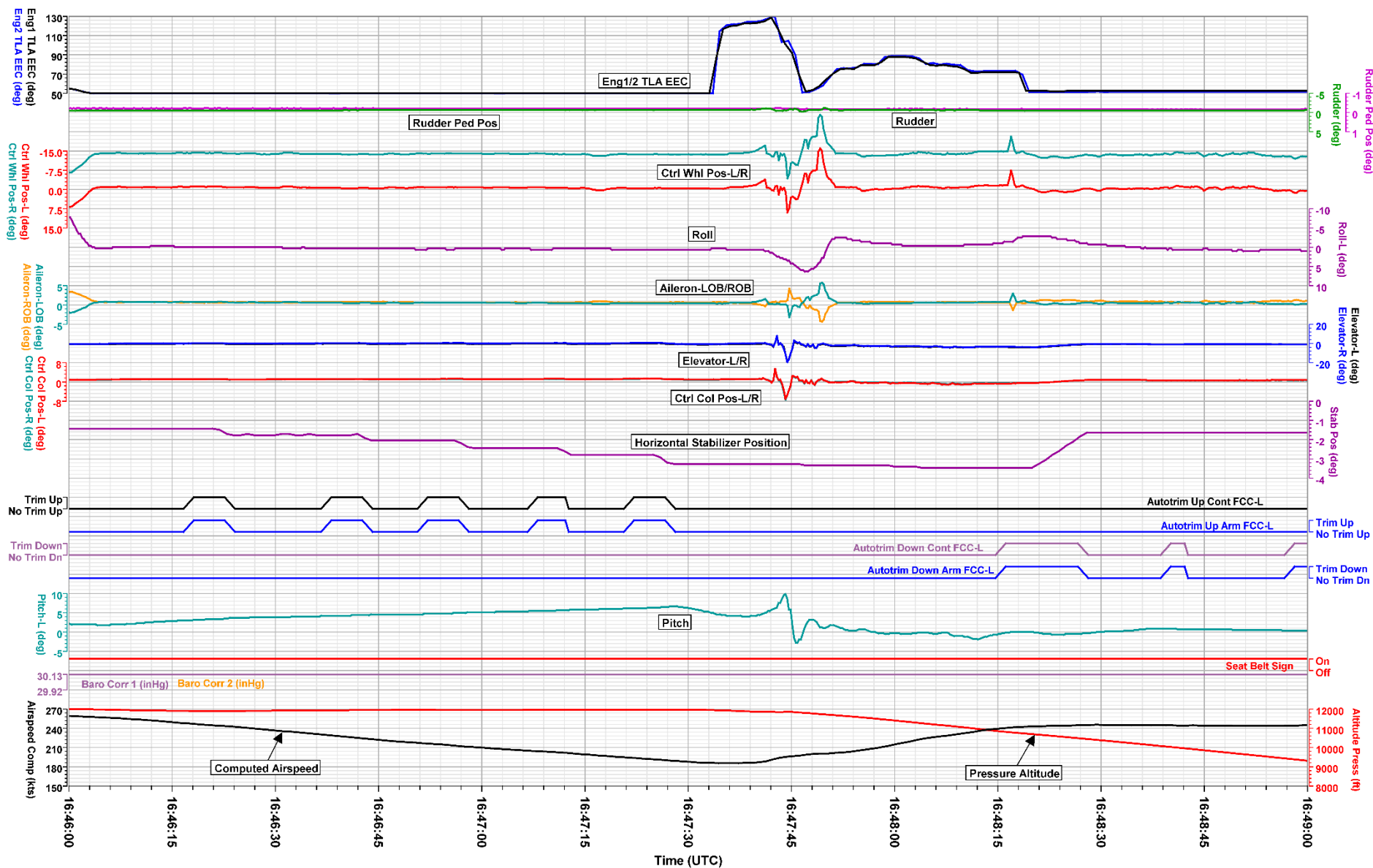


Figure 9. Plot of Flight Control Parameters During Event.

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	Parameter Names	Units
Accel Lat	Lateral Acceleration	g
Accel Long	Longitudinal Acceleration	g
Accel Vert	Vertical Acceleration	g
Aileron-LOB	Aileron Position – Left Outboard	deg
Aileron-ROB	Aileron Position – Right Outboard	deg
Airspeed Comp	Computed Airspeed	kts
Altitude Press	Pressure Altitude	ft
Altitude Select-Auto	Altitude Select – Auto	ft
Altitude Select-Man FCC-C/L/R	Altitude Select – Manual Flight Control Computer Center/Left/Right	ft
Altitude Select-Man MCP	Altitude Select – Manual Mode Control Panel	ft
AP Alt Hold Mode Oper	Autopilot Altitude Hold Mode Operational	-
AP Alt Hold Mode Oper FCC C/L/R	Autopilot Altitude Hold Mode Operational Flight Control Computer Center/Left/Right	-
AP Alt Hold Mode Oper MCP	Autopilot Altitude Hold Mode Operational Mode Control Panel	-
AP Alt Mode Oper	Autopilot Altitude Mode Operational	-
AP Alt Mode Oper FCC C/L/R	Autopilot Altitude Mode Operational Flight Control Computer Center/Left/Right	-
AP Engaged FCC-C/L/R	Autopilot Engaged Flight Control Computer Center/Left/Right	-
AP FI Ch Mode Oper	Autopilot Flight Change Mode Operational	-
AP FI Ch Mode Oper FCC C	Autopilot Flight Change Mode Operational Flight Control Computer Center/Left/Right	-
AP FI Ch Mode Oper MCP	Autopilot Flight Change Mode Operational Mode Control Panel	-
AP IAS	Autopilot Indicated Airspeed Mode	-
AP IAS FCC C/L/R	Autopilot Indicated Airspeed Mode Flight Control Computer Center/Left/Right	-
AP VNAV Mode Oper	Autopilot Vertical Navigation Mode Operational	-
AP VNAV Mode Oper FCC C/L/R	Autopilot Vertical Navigation Mode Operational Flight Control Computer Center/Left/Right	-
AP VNAV Mode Oper MCP	Autopilot Vertical Navigation Mode Operational Mode Control Panel	-
AP VS Mode	Autopilot Vertical Speed Mode	-
AP VS Mode FCC C/L/R	Autopilot Vertical Speed Mode Flight Control Computer Center/Left/Right	-
AP VS Mode Oper MCP	Autopilot Vertical Speed Mode Operational Mode Control Panel	-
AT Engaged	Auto Throttle Engaged	-
AT FI Ch Mode Oper TMC	Auto Throttle Flight Change Mode Operational Trust Management Computer	-
AT IAS Mode Oper	Auto Throttle Indicated Airspeed Mode Operational	-
AT Idle Thrust Oper	Auto Throttle Idle Thrust Mode Operational	-
AT Throttle Hld Annun	Auto Throttle Hold Mode Annunciation	-

Plot/Table Labels	Parameter Names	Units
AT VNAV Oper TMC	Auto Throttle Vertical Navigation Operational Thrust Management Computer	-
Autotrim Down Arm FCC-L	Autotrim Down Arm Flight Control Computer Left	-
Autotrim Down Cont FCC-L	Autotrim Down Continuous Flight Control Computer Left	-
Autotrim Up Arm FCC-L	Autotrim Up Arm Flight Control Computer Left	-
Autotrim Up Cont FCC-L	Autotrim Up Continuous Flight Control Computer Left	-
Baro Corr 1/2	Barometric Correction 1/2	inHg
Ctrl Col Pos-L/R	Control Column Position Left/Right	deg
Ctrl Whl Pos-L/R	Control Wheel Position Left/Right	deg
Elevator-L/R	Elevator Surface Position Left/Right	deg
Eng1/2 N1	Engine 1/2 N1	%rpm
Eng1/2 TLA EEC	Engine 1/2 Throttle Lever Angle Electronic Engine Control	deg
Gear WOW	Gear Weight-on-Wheels	-
Gear WOW-N	Gear Weight-on-Wheels – Nose	-
Ground Spd-L/R	Ground Speed Left/Right	kts
Heading Mag-L/R	Magnetic Heading Left/Right	deg
Master Caution	Master Caution	-
Min Maneuver Spd	Minimum Maneuvering Speed	kts
Pitch-L/R	Pitch Angle Left/Right	deg
Roll-L/R	Roll Angle Left/Right	deg
Rudder	Rudder Position	deg
Rudder Ped Pos	Rudder Pedal Position	deg
Seat Belt Sign	Seat Belt Sign Switch	-
Spd Select-Auto	Speed Selection Auto	kts
Spd Select-Man FCC-C	Speed Selection Manual Flight Control Computer Center/Left/Right	kts
Spd Select-Man MCP	Speed Selection Manual Mode Control Panel	kts
Stab Pos	Horizontal Stabilizer Position	deg
Time GMT Hrs	Time GMT Hours	hrs
Time GMT Min	Time GMT Minutes	min
Time GMT Sec	Time GMT Seconds	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 Abbreviations	Descriptions
deg	degrees
kts	knots
g	g
inHg	inches of mercury
ft	feet
hrs	hours
min	minutes
sec	seconds
%rpm	percent revolutions per minute